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Additions to "Les Muricidae de Polynésie Française" and description of a new species of *Morula* Schumacher, 1817 (Muricidae, Rapaninae) from French Polynesia

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KEYWORDS. Gastropoda, Muricidae, French Polynesia, new records, corrections, new species.

ABSTRACT. The revision of the French Polynesian Muricidae is addended and a new species, *Morula cernohorskyi*, is described from the Tuamotu and Society Archipelagos.

RESUMÉ. Quelques ajouts et corrections sont apportés à la révision des Muricidae de Polynésie Française. Une nouvelle espèce, *Morula cernohorskyi*, est décrite des Archipels des Tuamotu et de la Société.

I. INTRODUCTION

The French Polynesian muricids have been revised by TRÖNDLÉ & HOUART (1992). Seventy four species were recorded, of which three remained unidentified and six were considered to be endemic.

New records, modification in the classification, few corrections, and the discovery of new species have led us to write the present paper. In addition to the new species described here, two other taxa were recently named: *Orania simonetae* Houart, 1995, from the Marquesas Islands, and *Nassa tuamotuensis* Houart, 1996, from the Cook Islands, the Tuamotu, and the Society Archipelagos.

Nassa serta (Bruguière, 1789) is separated from *N. francolina*. It is recorded from Tubuai. The "true" *Nassa francolina* is not signalized in French Polynesia.

Other species, not signalized in TRÖNDLÉ & HOUART (1992) are here recorded for the first time: *Pterynotus elongatus* (Lightfoot, 1786), *Murexiella rosamiae* (D'Attilio & Myers, 1985), and *Morula angulata* (Sowerby, 1894), not *Morula angulata* in TRÖNDLÉ & HOUART (1992: 99).

Abbreviations

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

NMNZ: Museum of New Zealand, Wellington.

NM: Natal Museum, Pietermaritzburg, South Africa.

II. CORRECTIONS AND MODIFICATIONS

Subfamily **MURICINAE** Rafinesque, 1815

Chicoreus (Chicopinnatus) laqueatus (Sowerby, 1841)

TRÖNDLÉ & HOUART , 1992: 78, fig. 19

Chicoreus laqueatus was temporarily included in *Pterynotus* by TRÖNDLÉ & HOUART (1992: 78). It is now classified in *Chicopinnatus* (HOUART, 1992: 35, 113).

Pterymarchia bouteti (Houart, 1990)

TRÖNDLÉ & HOUART, 1992: 77, fig. 23

Pterymarchia martinetana (Röding, 1798)

TRÖNDLÉ & HOUART, 1992: 79, figs 25, 108

Pterymarchia tripterus (Born, 1778)

TRÖNDLÉ & HOUART, 1992: 79, fig. 26

These three species have been temporarily assigned to *Pterynotus*, awaiting a new genus. The genus *Pterymarchia* was described by HOUART (1995c: 127), with *Murex tripterus* as type species.

Subfamily **MURICOPSINAE**
Radwin & D'Attilio, 1971

Favartia brevicula (Sowerby, 1834)

Murex breviculus Sowerby, 1834: pl. 63, fig. 37

TRÖNDLÉ & HOUART, 1992: 114, fig. 36 (as *Favartia* sp.)

A specimen collected in Tubuai was compared with *Favartia brevicula* by HOUART (1986: 431, pl. 5, fig. 13). The species was already signalized in French Polynesia by SALVAT & RIVES (1975: 313, fig. 197), but TRÖNDLÉ & HOUART (1992: 69) listed it as doubtful in French Polynesia. However, new material containing young specimens, collected in 1993 in New Caledonia (MNHN), permits better comparison. It is now almost certain that the specimen illustrated in HOUART (1986) and in TRÖNDLÉ & HOUART (1992) is a subadult specimen of *F. brevicula*.

Subfamily **ERGALATAXINAE**
Kuroda & Habe, 1971

Orania pacifica (Nakayama, 1988)

TRÖNDLÉ & HOUART, 1992: 102 [as ?*Morula* (?*Morula*) *pacifica*]

The study of many specimens from throughout the geographical range of the species, and careful comparison with other species of the genus *Orania* (HOUART, 1995b) allow us now to classify that species definitely in the Ergalataxinae.

Pascula muricata (Reeve, 1846)

Ricinula muricata Reeve, 1846: pl. 5, fig. 39

TRÖNDLÉ & HOUART, 1992: 114, fig. 103 (as *Pascula* sp.)

Hundreds of specimens of that species have been examined and compared since 1992 (MNHN, NM, colls R. Houart, O. Simonet, J. Tröndlé). The species is now clearly identified as *Pascula muricata*. The holotype, together with several other specimens, was illustrated in HOUART (1995b).

Spinidrupa euracantha (A. Adams, 1853)

TRÖNDLÉ & HOUART, 1992: 105, fig. 90 [as *Morula* (*Spinidrupa*) *euracantha*]

Spinidrupa Habe & Kosuge, 1966 is considered to be monotypic. It was transfered from Rapaninae to Ergalataxinae (HOUART, 1995a), based on shell and radular characters.

Subfamily **RAPANINAE** Gray, 1853
(Thaidinae Jousseaume, 1888 in TRÖNDLÉ & HOUART, 1992)

Morula striata (Pease, 1868)

TRÖNDLÉ & HOUART, 1992: 103 (read fig. 79, not 80 as stated)

Morula uva (Röding, 1798)

TRÖNDLÉ & HOUART, 1992: 104 (read fig. 82, not 83 as stated)

Habromorula bicatenata (Reeve, 1846)

TRÖNDLÉ & HOUART, 1992: 105, fig. 90 [as *Morula* (*Spinidrupa*) *bicatenata*]

Habromorula porphyrostoma (Reeve, 1846)

TRÖNDLÉ & HOUART, 1992: 106, fig. 89 [as *Morula* (*Spinidrupa*) *porphyrostoma*]

Habromorula spinosa (H. & A. Adams, 1853)

TRÖNDLÉ & HOUART, 1992: 106, fig. 91 [as *Morula* (*Spinidrupa*) *spinosa*]

The three species, formerly included in *Morula* are now classified in *Habromorula*, a genus which differs from *Morula* in having a more elongate and usually more spiny, rather than nodulose shell, a narrower aperture, and more numerous, narrower, spiral cords and/or threads (HOUART, 1995a).

III. NEW RECORDS

Subfamily **MURICINAE** Rafinesque, 1815

Pterynotus elongatus (Lightfoot, 1786)

Murex elongatus Lightfoot, 1786: 65

A specimen of that species was recently collected in the Manihi Atoll, Tuamotu Archipelago. Two other specimens were collected at Arue, Tahiti Island (M. Boutet, in litt.). *P. elongatus* was not yet signalized from French Polynesia.

Subfamily **MURICOPSINAE** Radwin & D'Attilio, 1971

Murexiella rosamiae (D'Attilio & Myers, 1985)

Favartia rosamiae D'Attilio & Myers, 1985: 58, figs 1-6

The species was collected in Nuku Hiva, Marquesas Islands (coll. O. Simonet). *M. rosamiae* is known from many localities in the Indo-West Pacific. It is here recorded from French Polynesia for the first time.

Subfamily **ERGALATAXINAE** Kuroda & Habe, 1971

Orania simonetae Houart, 1995

Figs 1-2

Orania simonetae Houart, 1995b: 272, figs 140-141

The species is known from Nuku-Hiva, Marquesas Islands, living at 30 m (type locality). It was originally compared with *O. serotina* (A. Adams, 1853), *O. xuthedra* (Melvill, 1893), *O. archaea* Houart, 1995, and *O. mixta* Houart, 1995. The original description is here retranscribed from HOUART (1995b).

Description.

Shell small, up to 12.7 mm in length at maturity, weakly spinose, squamous. Spire high, acute, with 3+ protoconch whorls (incomplete) and up to 6 weakly convex, narrow teleoconch whorls with weakly adpressed suture. Protoconch conical, smooth. Terminal varix unknown (eroded).

Axial sculpture consisting of moderately high axial ribs: 8 on first and second teleoconch whorls, 9 from third to fifth whorl, 7 or 8 on last whorl.

Spiral sculpture consisting of primary and secondary, squamous cords, and narrow threads between the cords. First whorl partly eroded, second to fifth whorl each with 3 cords; last whorl bearing 4 cords with one thread between first three adapical cords and two threads between third and fourth cords. Shoulder of early whorls smooth; last whorls occasionnally with 2 or 3 low threads on shoulder.

Aperture ovate, moderately small. Columellar lip smooth, except two low nodes abapically, rim adherent. Anal notch broad, deep. Outer lip erect, crenulate, with 6 short, elongate nodes within.

Siphonal canal short, narrow, open, abaperturally bent, ornamented with squamous spiral cords.

Withish or light pinkish. Adapical part of shoulder and fourth abapical spiral cord of last whorl brown.

Aperture glossy white or light pink.

Radula unknown.

Subfamily **RAPANINAE** Gray, 1853 (Thaidinae Jousseaume, 1888 in TRÖNDLÉ & HOUART, 1992)

Morula angulata (Sowerby, 1894)

Figs 4-7

NOT *Morula angulata* - CERNOHORSKY, 1987: 100 (in part), figs 20-21 (only); TRÖNDLÉ & HOUART, 1992: 99, fig. 76 (= *Morula cernohorskyi* n.sp.)

Morula angulata (Sowerby, 1894) is a small species, not reaching 10 mm in length, originally described from Mauritius. Other specimens were recently collected in Tahiti (coll. Wargnier), and in Guam (coll. Schroeder). It was confused with another small species of *Morula* from French Polynesia by CERNORHORSKY (1987:100), and by TRÖNDLÉ & HOUART (1992: 99). However, TRÖNDLÉ & HOUART (1992: 100) observed some differences between the holotype of *Sistrum angulatum* Sowerby, 1893 and the Polynesian shell identified as *Morula angulata* by CERNORHORSKY (1987: 100) but the material examined was not sufficient and damaged. The shell, wrongly identified as *M. angulata* by these authors, is in fact a new species described farther.

Nassa serta (Bruguière, 1789)

Fig. 11

Buccinum sertum Bruguière, 1789: 262, pl. 397, fig. 2

There are two specimens of *N. serta* from Tubuai in the material examined by TRÖNDLÉ & HOUART (1992: 113), all other records are *N. tuamotuensis* Houart, 1996 (see below). However, these authors considered then the name *serta* as a junior synonym of *Nassa francolina* (Bruguière, 1789). In a recent study HOUART (1996), demonstrated they are separate species. *N. serta* differs constantly from *N. francolina* in being usually more narrowly ovate, and in having fewer, stronger, weakly nodular spiral cords (last whorl with 59-62 cords, compared to 98-102 in *N. francolina*, from sutural line to the extremity of the siphonal canal). Tubuai is also the eastern limit of the geographical distribution of *N. serta*.

Nassa tuamotuensis Houart, 1996

Figs 8-10

Nassa francolina - TRÖNDLÉ & HOUART, 1992: 113, fig. 13 (not Bruguière, 1789).

Nassa tuamotuensis Houart, 1996: 56, figs 7, 31-41.

The species is known from the Cook Islands and several localities in the Tuamotu and the Society Archipelagos (French Polynesia). Its original

description and remarks are here partly retranscribed from HOUART (1996).

Description.

Shell up to 63.7 mm in length at maturity (Faaone, Tahiti), heavy. Subsutural area of teleoconch whorls weakly to strongly concave, spire high, acute. Up to 7 teleoconch whorls. Suture strongly adpressed. Terminal varix of protoconch erect, of sinusigera type, number of whorls unknown (broken).

Axial sculpture of teleoconch whorls consisting of low ribs: first to third whorl with 19 or 20 ribs, gradually decreasing in strength, obsolete from fourth whorl. Spiral sculpture of first to penultimate whorl of low, primary, secondary and tertiary cords, last whorl with low cords on subsutural area, on abapical part of whorl, and on the siphonal canal, periphery almost smooth.

Aperture large, elongate, broadly ovate. Columellar lip smooth with elongate, adapical ridge within the aperture, delineated anal notch. Outer lip smooth, edge weakly crenate within. Siphonal canal short, broad, open.

Creamy-white, light tan or golden-brown with darker coloured axial bands, occasionally with darker axial and spiral bands together. Aperture creamy-white inside, dark brown on outer apertural edge and on abapical part of columellar lip.

Operculum and radula unknown.

Remarks.

Nassa tuamotuensis has been usually confused with *N. francolina* (Bruguière, 1789), certainly because of its smooth shell surface. However, *N. francolina* is confined in the Indian Ocean, whereas *N. tuamotuensis* occurs in the Central Pacific, the usual geographical range of *N. serta* (Bruguière, 1789). Strangely, *N. serta* is known from many localities but is apparently absent from the localities occupied by *N. tuamotuensis*.

The shell of *N. tuamotuensis* is heavier and thicker than *N. francolina*, it is also more slender, and has a very peculiar spiral sculpture, different from any of the other species of *Nassa* (HOUART, 1996). It also differs in its concave subsutural area, occasionally present in other species, but in a very lighter way, and in its particular coloration, with narrow, axial brown bands.

IV. NEW SPECIES

Morula cernohorskyi n.sp.

Fig. 3

Morula angulata - CERNOHORSKY, 1987: 100 (in part), figs 20-21 (only); TRÖNDLÉ & HOUART, 1992: 99, fig. 76 [not *Morula angulata* (Sowerby, 1894)], now the holotype of *M. cernohorskyi* n.sp.

Material examined.

French Polynesia, Tuamotu Archipelago, Mururoa Atoll, holotype and 3 paratypes MNHN, 1 paratype NMNZ M.272478, 2 paratypes coll. J. Tröndlé, 3 paratypes coll. R. Houart; Tuamotu Archipelago, Anaa, 1 paratype coll. J. Tröndlé; Society Archipelago, Tahiti, Afaahiti, 1 paratype coll. J. Tröndlé.

Type locality.

French Polynesia, Tuamotu Archipelago, Mururoa Atoll, 22.00' S, 140.00' W.

Description.

Shell small, up to 6.3 mm in length (paratype coll. J. Tröndlé), biconical, stout, weakly spinose. Spire high with 3-3.5 protoconch whorls, and up to 4 shouldered teleoconch whorls. Suture impressed. Protoconch conical, acute, smooth, glossy. Terminal varix strong, curved, of sinusigera type.

Axial sculpture of teleoconch whorls consisting of moderately high, strong ribs, with short, narrowly open spines: 9 ribs on first whorl, 9 or 10 on second, 10 on third, 8-10 on last. Spiral sculpture of strong, squamous, rounded cords: first to third whorl with a single, heavy, carinal cord; last whorl with 5, longitudinally striate, rounded cords, occasionally with a single thread between these. Shoulder with a single, shallow, broad cord, just below suture. Presence of short, open, blunt spinelets at intersection of axial ribs and spiral cords. Carinal spinelets longest.

Aperture small, narrow, ovate; columellar lip with 2 or 3 elongate, weak knobs abapically; rim adherent; anal notch broad, deep; outer lip smooth, with 4 strong denticles within, adapical denticle strongest. Siphonal canal short, straight, open, with 2 weak, spiral threads.

Light orange, yellow-tan or tan with carinal, third, fifth spiral cords, and tip of siphonal canal dark brown. Aperture of the same colour, with dark brown, narrow bands inside.

Radula and operculum unknown.

Remarks.

Morula angulata (Sowerby, 1894) (Figs 4-7) which was confused with *M. cernohorskyi* n.sp. is relatively larger, with four primary and two secondary, spinose, narrow, spiral cords on last whorl. The two secondary cords are situated between the shoulder, and next abapical primary cord. The last whorl is relatively broader, and more shouldered than in *M. cernohorskyi*. The colour is also different, milky-white with secondary, and last adapical primary cords dark brown or black.

In the same group of small species of Indo-Pacific *Morula*, there are other species, namely: *M. echinata* (Reeve, 1846) and *M. parva* (Reeve, 1846). Both species are larger than *M. cernohorskyi* relative to the number of teleoconch whorls, with narrower, more numerous spiral cords, and different coloration. They

have six spiral cords on last teleoconch whorl and one on the siphonal canal. *M. echinata* is milky-white or light tan with the first abapical spiral cord of last whorl punctuated with orange spots, two next abapical cords uniformly coloured, fourth, fifth, and sixth, or fourth and sixth, milky-white or brown, punctuated with orange spots. *M. parva* is milky-white and less spinose, with first, second, fourth and sixth spiral cords of last whorl being dark brown or black, third and fifth cords are punctuated with orange spots. *M. echinata* occurs in French Polynesia, and *M. parva* was recorded from Luzon, Philippine Islands (type locality), and from Ambon Island, Indonesia (Houart, in press).

Morula parvissima Cernohorsky, 1987, from French Polynesia, is narrower, not shouldered, with broader, nodose, spiral cords, and different coloration. It is milky-white with alternatively white and black spiral cords.

Etymology.

Named after Walter O. Cernohorsky, author of numerous papers and books on Indo-Pacific Mollusca.

Conclusion.

TRÖNDLÉ & HOUART (1992) cited 74 species of Muricidae from French Polynesia, of which three remained unidentified. Of these three species, two are now identified as *Favartia brevicula* (Sowerby, 1834) and *Pascula muricata* (Reeve, 1846).

The total number of Muricidae known by us from French Polynesia is now of 79 species, of which one remains unidentified.

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REFERENCES

BRUGUIERE, M. 1789. Encyclopédie méthodique ou par ordre de matières, par une société de gens de lettres, de savants et d'artistes... *Histoire Naturelle des Vers, des Mollusques... I: I-XVIII*, 1-344.

CERNOHORSKY, W.O. 1987. Type specimens of Pacific Mollusca described mainly by A. Garrett and W. Pease with description of a new *Morula* species (Mollusca: Gastropoda). *Rec. Auckland Inst. Mus.* 24: 93-105.

D'ATTILIO, A. & B.W. MYERS. 1985. Two new species of *Favartia* from the West Pacific Ocean (Gastropoda: Muricidae). *Nautilus* 99 (2-3): 58-61.

HOUART, R. 1986. Mollusca Gastropoda: Noteworthy Muricidae from the Pacific ocean, with description of seven new species. *Mém. Mus. Natn. Hist. Nat., Paris* (A) 133: 427-455.

HOUART, R. 1992. The genus *Chicoreus* and related genera (Gastropoda: Muricidae) in the Indo-West Pacific. *Mém. Mus. Natn. Hist. Nat. Paris*, (A), 154: 1-188.

HOUART, R. 1995a. Some notes on the genus *Spinidrupa* Habe and Kosuge, 1966 (Muricidae: Ergalataxinae), with the description of *Habromorula* gen. nov. (Muricidae: Rapaninae) and four new species from the Indo-West Pacific. *Iberus* 12 (2): 21-31.

HOUART, R. 1995b. The Ergalataxinae (Gastropoda, Muricidae) from the New Caledonia region with some comments on the subfamily and the description of thirteen new species from the Indo-West Pacific. *Bull. Mus. Natn. Hist. Nat., Paris* (A) 16 (2-4): 245-297.

HOUART, R. 1995c. *Pterymarchia* n. gen. and *Vaughtia* n. gen., two new muricid genera (Gastropoda: Muricidae: Muricinae and Ocenebrinae). *Apex* 10 (4): 127-136.

HOUART, R. 1996. The genus *Nassa* Röding 1798 (Gastropoda: Prosobranchia: Muricidae: Rapaninae) in the Indo-West Pacific. *Archiv für Molluskenkunde* 126: 51-63.

LAMARCK, J.B.P.A., de M. de. 1816. *Tableau encyclopédique et méthodique des trois règnes de la nature*, 23è part., mollusques et polypes divers, Paris: pls. 391-488.

LIGHTFOOT, J. 1786. *A catalogue of the Portland Museum, lately the property of the Duchess Dowager of Portland, deceased: which will be sold by auction* .... London. vii + 194 pp.

REEVE, L.A. 1846. *Conchologia iconica, or illustration of the shells of molluscous animals. Monograph of the genus* Ricinula. L. Reeve, London, vol. 3: pls. 1-6.

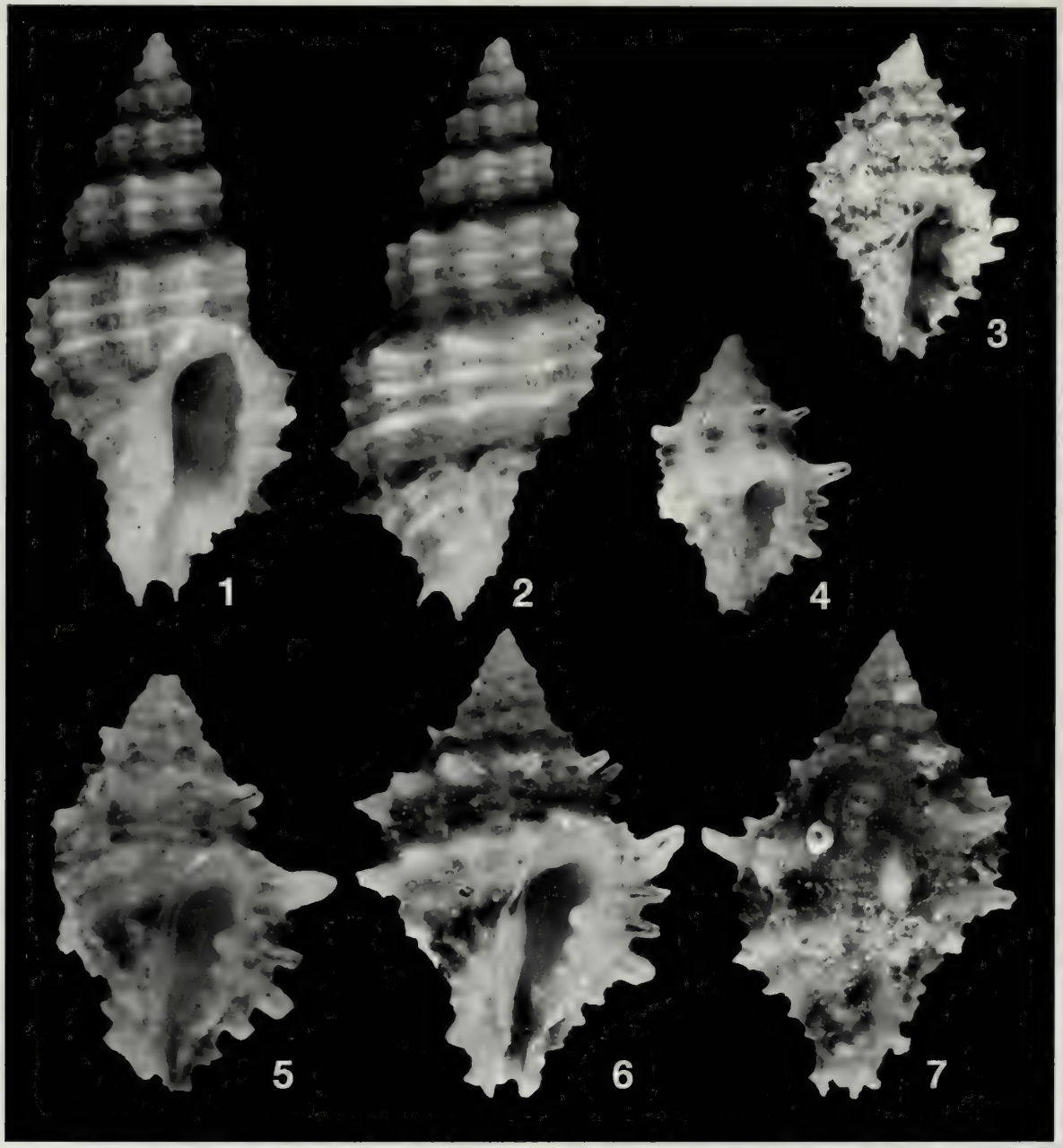
RICHARD, G. 1985. Fauna and flora, a first compendium of French Polynesian sea-dwellers. *in* B. DELASALLE, R. GALZIN & B. SALVAT (Eds). *5th International Coral Reef Congress, Tahiti*. Vol. 1: "French Polynesian Coral Reefs": 379-520.

SALVAT, B. & C. RIVES. 1975. *Coquillages de Polynésie*. Les éditions du Pacifique, Papeete, Tahiti: 391 pp.

SMITH, E.A. 1884. *Report of the zoological collections made in the Indian Ocean during the voyage of H.M.S ALERT, 1881-2*. Trustees of the British Museum: 1-684.

SOWERBY, G.B. 1834-1841. *The Conchological Illustrations*, Murex, *Sowerby*, London: pls 58-67 (1834); pls 187-199 + catalogue: 1-9 (1841).

TRÖNDLÉ , J. & R. HOUART. 1992. Les Muricidae de Polynésie Française. *Apex* 7 (3-4): 67-149.

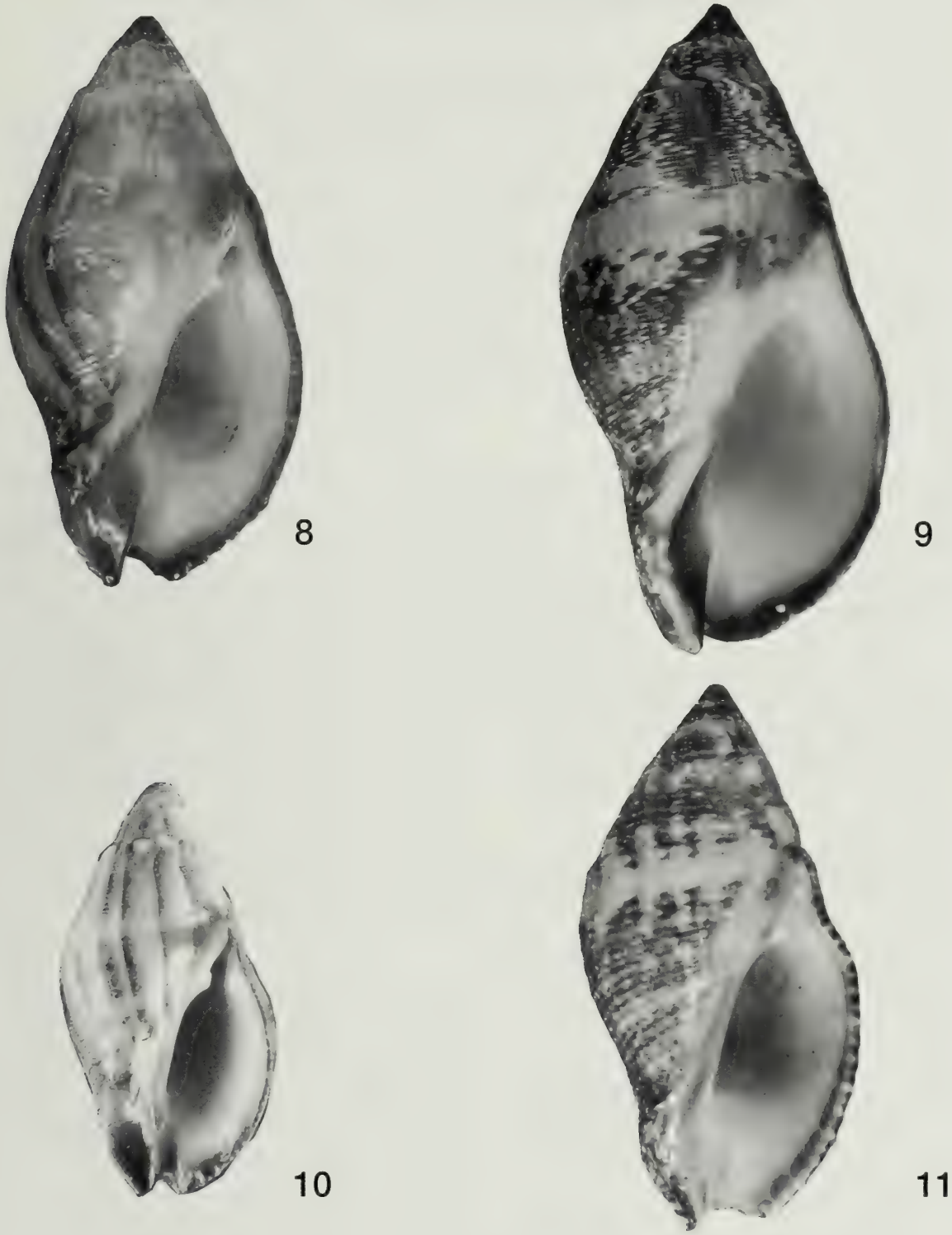


Figures 1-7

1-2. *Orania simonetae* Houart, 1995. Holotype MNHN, Nuku Hiva, Marquesas Islands, 12.5 mm

3. *Morula cernohorskyi* n.sp. Holotype MNHN, Tuamotu Archipelago, Mururoa Atoll, 6 mm

4-7. *Morula angulata* (Sowerby, 1894) ; **4**. Holotype BMNH 1902.11.26.72, Mauritius, 6.8 mm ; **5**. Society Archipelago, Tahiti, west coast, coll. Wargnier, 6.7 mm ; **6-7**. Guam, Pita Reef, coll. Schroeder, 8.2 mm.



Figures 8-11

8-10. *Nassa tuamotuensis* Houart, 1996 ; **8**. Holotype MHNG 1101/59, Indian Ocean (erroneous), 48 mm ; **9**. Society Archipelago, Tahiti, Faaone, coll. Tröndlé, 63.7 mm ; **10**. Tuamotu Archipelago (no other data), IRSNB IG10591, 47.2 mm.

11. *Nassa serta* Bruguière, 1789. Tubuai, coll. J. Tröndlé, 44.6 mm.

Effect of water depth on the hatching of eggs of three disease transmitting freshwater snails

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KEYWORDS. Vector snails, eggs, water depth, incubation period, hatchability.

ABSTRACT. The eggs of three disease transmitting freshwater snails, *Lymnaea (Radix) luteola, L. (R.) acuminata* and *Indoplanorbis exustus*, were kept at different depths of water to detect effects on the development of embryos and hatching. For all three species, hatching decreased with increasing water depth. The eggs of *L. (R.) acuminata* and *I. exustus* failed to hatch when kept at a depth of 2.1 m or more those of *L.(R.) luteola* failed to hatch when kept at a depth of 2.4 m. The incubation period gradually increased with water depth.

INTRODUCTION

The freshwater snails *Lymnaea (Radix) luteola* Lamarck, *L. (R.) acuminata* Lamarck and *Indoplanorbis exustus* (Deshayes) are known intermediate hosts for some worm parasites such as *Fasciola gigantica, F. hepatica, Schistosoma indicum, S. nasalis, S. spindalis, Clinostomum giganticum* and others, causing diseases in man and his domestic animals (RAUT 1986; SUBBA RAO 1989). A number of studies (DURANI & CHAUDHURY 1967; ISLAM 1977; CHITRAMVONG *et al.* 1981; RAUT & GHOSH 1985; PARASHAR & RAO 1986; PARASHAR *et al.* 1986; RAUT & SAHA 1989; RAUT & MISHRA 1991, 1993; SAHA & RAUT 1992; RAUT *et al.* 1992; MISHRA & RAUT 1993) were effected with the aim of controlling the snail-borne diseases through the management of snail population. To achieve success, we still need more information on the biology and ecology of the vector molluscs.

These snails are found in large numbers in ponds and other freshwater bodies. in which they deposit eggs on a variety of substrates (fixed or not), normally near to the surface of the water. It could thus be expected that the development of the eggs could be hampered, if forced to take place in deeper water, for instance due to the heavy monsoon rainfall.

This work reports an experimental study of the effect of water depth on the hatchability of eggs of *L. (R.) luteola, L. (R.) acuminata* and *I. exustus* in a pond in Calcutta, West Bengal, India.

MATERIALS AND METHODS

Sexually mature specimens of *L. (R.) luteola, L. (R.) acuminata* and *I. exustus* were collected from the pond located in the Ballygunge Science College campus, Calcutta University, Calcutta, in the first week of December 1993. The species were then raised separately, following the methods suggested by RAUT (1991), in 45x15x30 cm aquaria, in their water of origin, with a few aquatic plants (*Vallisneria, Ipomea* and *Lemna*) to provide a support for the snails to rest and lay eggs on. The molluscs were regularly fed with lettuce leaves. The snails started laying eggs within a few days.

The eggs were then returned under controlled conditions, as described here under, to the pond of origin of the snails. The experiments were initiated when the required number of eggs was available. At least 50 eggs were observed for each case.

The experimental set-up consisted in groups of three open-mouthed glass tubes (7 cm long and 2 cm diameter) tightened, at an interval of 15 cm, to a weighted 3 m nylon rope, rope secured to and hanging along a bamboo pole planted into the deepest part of the pond. The uppermost group of glass tubes was kept at the water surface (depth zero); the lowermost group being then at a depth of 270 cm. Series of three tubes at 19 predetermined depths could thus be raised or lowered in the water at will. Three such devices were used simultaneously providing three independent experiments and a total of 57 glass tubes. The experimental site of the pond was clean and exposed to direct sunlight for a daily period of 6 hours.

Plant parts bearing a recorded number of egg capsules, laid on the same day, of the three species of snails under study, were transferred into the tubes, which were then closed at both ends with 0.01 mesh nylon net. The eggs of the three species were kept separate for every tested depth. The eggs were examined, the hatched eggs counted and removed from the tubes at every 24 hours interval for a period of 40 days. The average hatching percentages was computed for eggs of each species, at each pre-set depth, in three sets of experiments.

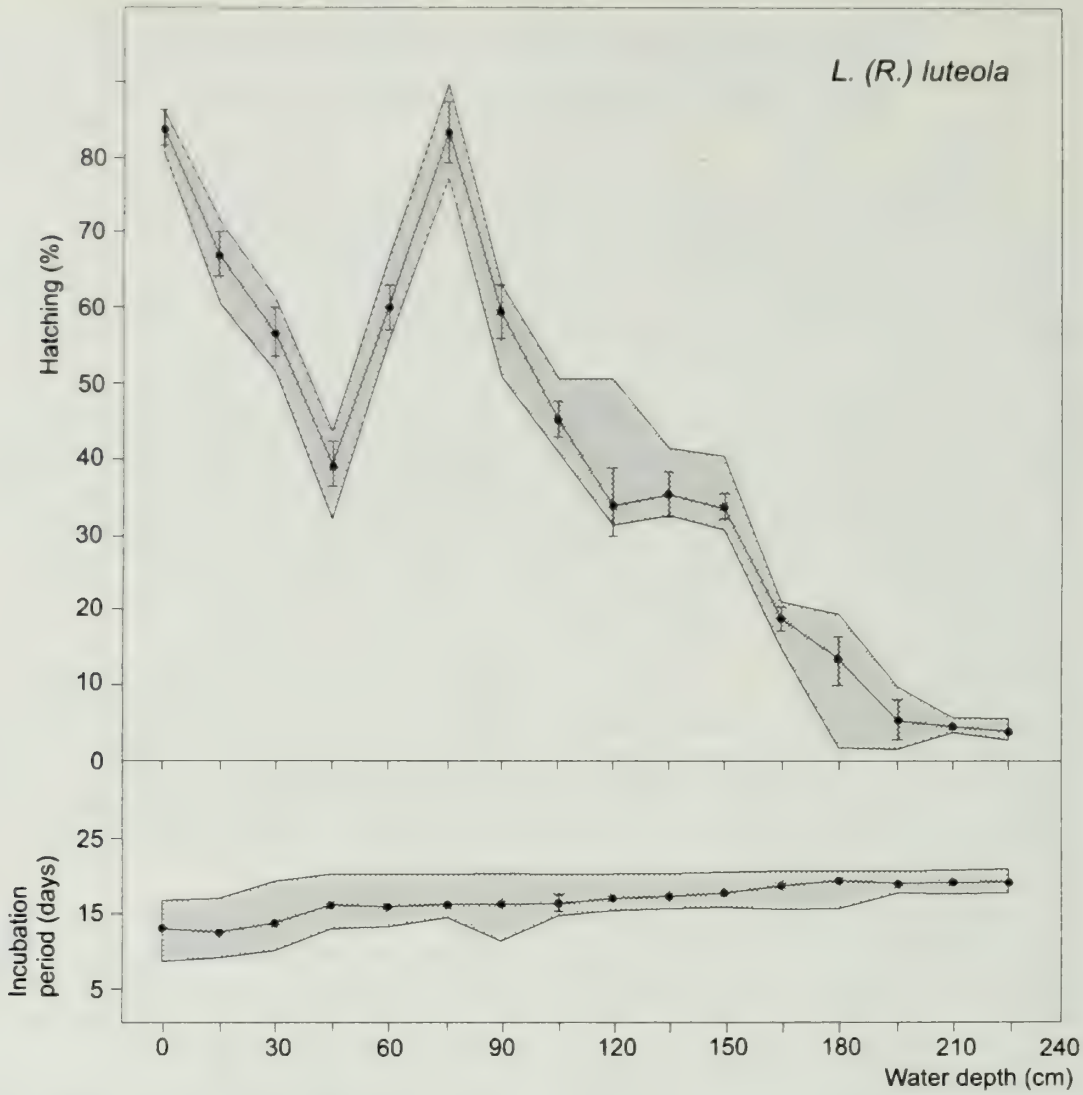

Figure 1. Hatching period and hatching percentages of the eggs of *L.(R.) luteola*. Range (shadowed area) and mean +/- S.E. (error bars not shown if very small).

RESULTS

At depth zero the incubation period of the eggs was 9-17 days for *L. (R.) luteola*, 11-19 days for *L. (R.) acuminata* and 9-14 days for *I. exustus*. The duration of the developmental period of the embryos and the percentages of eggs hatching varied both with the depth and with the species of the snails (Figures 1-3). Total failure to hatch was observed at 210 cm for *L. (R.) acuminata* and *I. exustus*, at 240 cm for *L. (R.) luteola*. The unhatched eggs of all the glass tubes were distorted and spoiled within 40 days.

Hatching time. The minimum hatching time is 9 days for the eggs of *L. (R.) luteola* and *I. exustus*, 10 days for *L. (R.) acuminata*. If kept in depths 0 to 15 cm [for *L. (R.) luteola*], 0 to 30 cm (for *I. exustus*) and 0 to 15 cm [for *L.(R.) acuminata*] only some of the eggs hatch in this minimum time while others require 10 to 14 days (for *I. exustus*), 10 to 17 days [for *L. (R.) luteola*] and 11 to 17 days [for *L. (R.) acuminata*]. (Figures 1-3).

The maximum hatching time at depth zero was 14, 17 and 19 days for *I. exustus*, *L. (R.) luteola* and *L. (R.) acuminata*, respectively. For *L. (R.) luteola*, the maximum hatching time increased by one or two days at the depths of 15 to 30 cm, but never exceeded 20 days at any deeper location. At depths of 30 to 195 cm, the maximum hatching time ranged from 16 to 24 days and 20 to 25 days for *I. exustus* and *L. (R.) acuminata*, respectively.

Hatching of the eggs of the three snail species was thus considerably delayed by increasing the water depth. The minimum hatching time increased by 1 to 9 days for *L. (R.) luteola*, 1 to 7 days for *L. (R.) acuminata* and 1 to 5 days for *I. exustus*. The maximum hatching time increased by 2 to 10 days for *I. exustus*, 2 to 3 days for *L. (R.) acuminata* and 1 to 6 days for *L. (R.) luteola* (Figures 1-3).

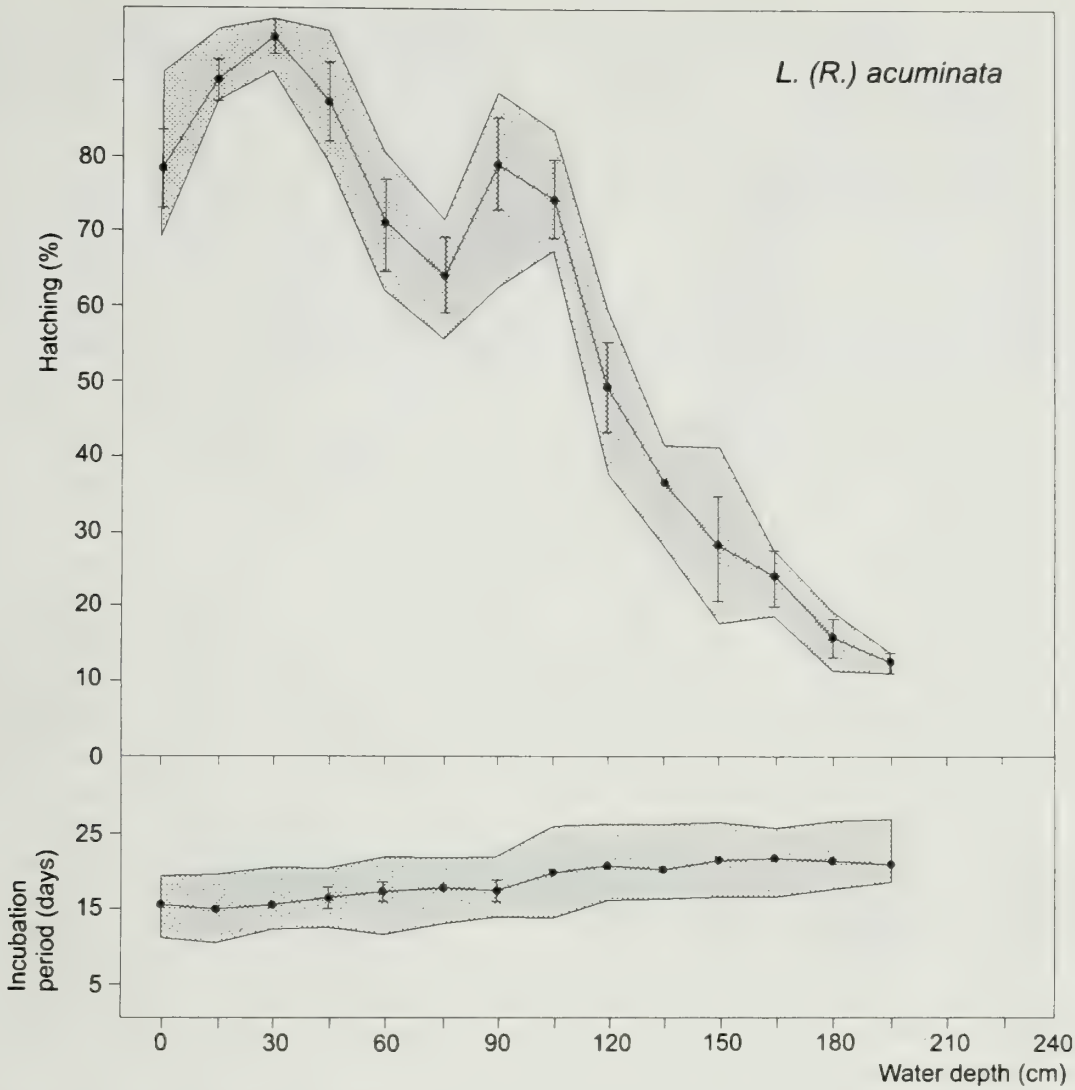

Figure 2. Hatching period and hatching percentages of the eggs of *L. (R.) acuminata*. Range (shadowed area) and mean +/- S.E. (error bars not shown if very small).

Hatching success. The percentage of eggs hatching varied with the depth of water. 84% of the eggs of *L. (R.) luteola* hatched when kept at depth zero, but only an average 2.6% when kept at 2.30 m. The same general trend is observed for the eggs of *L. (R.) acuminata* and *I. exustus*, for which the percentage of hatching falls to around 10% at the deepest depth tolerated (1.95 m).

DISCUSSION

It is to be noted that hatching time is a monotonous function of water depth, but hatching success is not. While the general trend of decreasing hatchability with increases depth is common to the three species, a small abnormally occurs around depths of 90 cm for *L. (R.) acuminata*. This corresponds to a larger peak of recovery around at around -90 cm for *L. (R.) luteola* and a large, significant zone of relative success in the depth zone from -90 to -150 cm for *I. exustus*. The depth of the water plays a significant role in regulating the developmental process of the embryos but one should also note that the observed effect might be due to a number of factors such as pressure, intensity of light, temperature, pH, the amount of dissolved O_2 and the ionic concentrations of water at different depths.

In eggs laid in fresh water, a great discrepancy exists between the inner and outer osmotic pressure (RAVEN 1972). The envelopes and capsular membranes of the eggs of *Lymnaea* and *Biomphalaria* are permeable to water and inorganic ions (BEADLE 1969; RAVEN 1970). As a rule, the eggs are in osmotic equilibrium with water; they swell upon dilution of the medium and shrink when it is made hypertonic.

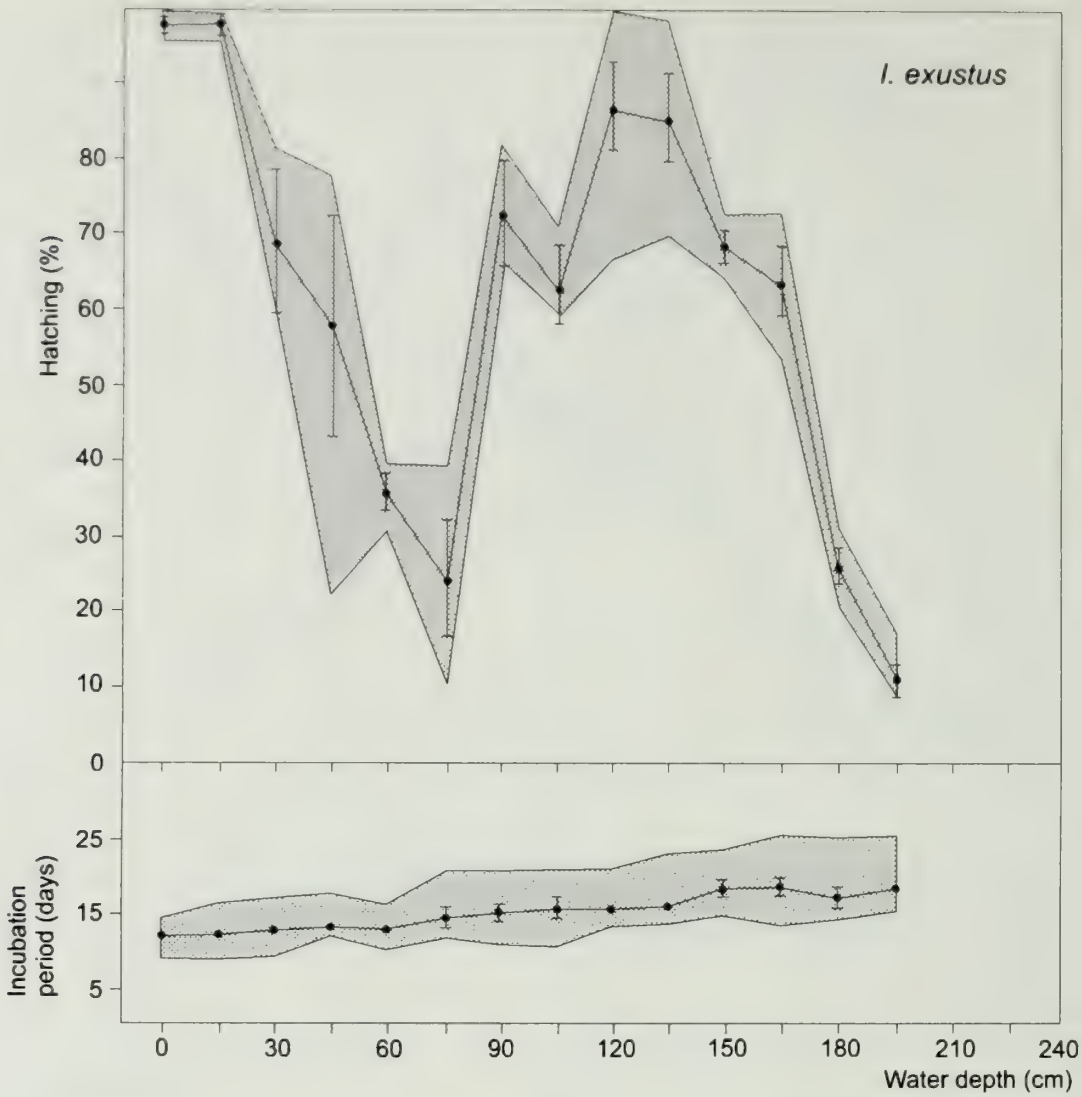

Figure 3. Hatching period and hatching percentages of the eggs of *I. exustus*. Range (shadowed area) and mean +/- S.E. (error bars not shown if very small).

We may expect to find in such eggs special mechanisms preventing excessive swelling (RAVEN 1972). This swelling is an osmotic phenomenon and its rate is regulated by the osmotic pressure of the medium (RAVEN & KLOMP 1946). The swelling of the eggs of *Lymnaea* continues after the onset of cleavage, even at a greatly increased rate (RAVEN *et al.* 1952; RAVEN 1966). This cannot be explained by the increase in surface area or a rise in osmotic pressure of the cells, but must be due to an increase in water permeability of the egg surface (RAVEN 1972). Incorporation of P^{32} into RNA shows a sharp increase during the third day of development of *Ilyanassa* eggs (RAVEN 1972). According to BRAHMACHARY *et al.* (1968), phosphorus-32 incorporation in *Lymnaea* begins in the uncleaved eggs, rises to a peak at the late trochophore stage, then declines throughout the veliger stage.

ROSS & HARRISON (1977) cultured eggs of the basommatophoran snails *Physa marmorata* and *Biomphalaria glabrata* in low concentrations of calcium, to determine effects on growth and development. In both species there was some development in media with 0.112 mg/l Ca^{++} but embryos did not hatch. 61% embryos of *P. marmorata* hatched in 0.22 mg/l Ca^{++} but those of *B. glabrata* required a level of 0.42 mg/l Ca^{++} to attain even a 31% hatch. Very low calcium levels induced marked effects on growth rate, embryo size and on hatching time taken in both species. These data indicate that a number of phenomena in the development of eggs imply ions exchange. Any obstacle to ions exchange is a danger for the eggs and invites different types of problems due to accumulation or release of different ions, and could inhibit the process of development, as it has been noted in case of the incorporation of P^{32} (BRAHMACHARI *et al.* 1968).

We have no data on ions concentrations neither in the water at the different depths that were tested, nor within the eggs; but we know that these ions concentrations are very much influenced by temperature and light. It is also known that temperature has a direct, significant impact on the development of eggs (DREGOLSKAYA 1986; SAHA & RAUT 1992). Pond water is clinograde, the amount of dissolved O_2 being maximum at the surface and gradually decreasing with increasing depth (GOLDMAN & HORNE 1983). It is thus likely that the eggs kept in deep waters suffer a deficiency of oxygen, inhibiting the development of the embryo.

Several factors being probably involved, understanding the mechanisms of the observed effects still requires further study. As *L. (R.) luteoa, L. (R.) acuminata* and *I. exustus* are very much involved with the spread of worm diseases any process reducing the density of these snail populations should be considered. Impairing the development of the eggs by controlling water depth could be an effective method.

ACKNOWLEDGEMENTS. The authors are thankful to the Head of the Department of Zoology, Calcutta University, for the facilities provided. We are grateful to Prof. Bernard TURSCH, Université Libre de Bruxelles, for constructive criticisms and valuable suggestions.

REFERENCES

BEADLE, L.C. 1969. Salt and water regulation in the embryos of freshwater pulmonate molluscs 1. The embryonic environment of *Biomphalaria sudanica* and *Lymnaea stagnalis*. *J. exp. Biol.* 50: 481-489.

BRAHMACHARY, R.L., K.P. BANERJEE & T.K. BASU. 1968. Investigations on transcription in *Lymnaea* embryos. *Exp. Cell. Res.* 51: 177-184.

CHITRAMVONG, Y.P., E.S. UPATHAM & N. SUKHAPANTH. 1981.Effect of some physico-chemical factors on the survival of *Bithynia siamensis, Radix rubiginosa* and *Indoplanorbis exustus*. *Malacol. Rev.* 14: 43-48.

DREGOLSKAYA, I.N. 1986. The asynchronism of hatching and the variability of heat resistance in juvenile pond snail *(Lymnaea fragilis)*. *Zh. Obshch. Biol.* 47: 417-421.

DURANI, M.Z. & A.H. CHAUDHURY. 1967. Studies on the life-cycle of *Indoplanorbis exustus* (Planorbidae: Gastropoda) under controlled conditions. *Pak. J. Vet. Sci.* 1: 14-16.

GOLDMAN, C.R. & A.J. HORNE. 1983. *Limnology*. International Student Edition. McGraw-Hill International Book Company. Tokyo, Japan. xiii + 464 pp.

ISLAM, K.S. 1967. A note on the life-cycle of *Indoplanorbis exustus* (Deshayes) under laboratory conditions. *Ind. J. Anim. Sci.* 47: 374-376.

MISRA, T.K. & S.K. RAUT. 1993. Dynamic of population - dynamics in a medically important snail species *Lymnaea (Radix) luteola* (Lamarck). *Mem. Inst. Oswaldo Cruz,* Rio de Janeiro 88: 469-485.

PARASHAR, B.D. & K. M. RAO. 1986. Effects of long-term exposure to low concentrations of molluscicides on a freshwater snail, *Indoplanorbis exustus*, vector of schistosomiasis. *Malacologia* 27: 265-269.

PARASHAR, B.D., A. KUMAR & K.M. RAO. 1986. Role of food in mass cultivation of the freshwater snail, *Indoplanorbis exustus,* vector of animal schistosomiasis. *J. Moll. Stud.* 52: 120-124.

RAUT, S.K. 1986. Snails and slugs in relation to human diseases. *Env. & Ecol.* 4: 130-137.

RAUT, S.K. 1991. Laboratory rearing of medically and economically important molluscs. pp. 79-83. In: Director, Zoological Survey of India (ed.). *Snails, flukes and man. Zoological Survey of India, Calcutta.*

RAUT, S.K. & UMA GHOSH. 1985. Egg capsules of some freshwater disease transmitting snails. *Env. & Ecol.* 3: 214-217.

RAUT, S.K. & T.C. SAHA. 1969. The role of the water-bug *Sphaerodema annulatum* in the control of disease transmitting snails. *J. Med. Appl. Malacol.* 1: 97-106.

RAUT, S.K. & T.K. MISRA. 1991. Effect of salinity on the growth of three medically important snail species. *Bull. Malacol. R.O.C.* 16: 67-74.

RAUT, S.K. & T.K. MISRA. 1993. Influence of salinity on the breeding of three medically important freshwater snail species. *Malacol. Abh. Mus. Tierkd. Dresden.* 16: 173-176.

RAUT, S.K., M.S. RAHMAN & S.K. SAMANTA. 1992. Influence of temperature on survival, growth and fecundity of freshwater snail *Indoplanorbis exustus* (Deshayes). *Mem. Inst. Oswaldo Cruz*, Rio de Janeiro 87: 15-19.

RAVEN, C.P. 1966. *Morphogenesis: The analysis of molluscan development*. 2nd ed. Pergamon Press, London. xiii + 365 pp.

RAVEN, C.P. 1970. The cortical and subcortical cytoplasm of the *Lymnaea* egg. *Int. Rev. Cytol.* 28: 1-44.

RAVEN, C.P. 1972. Chemical embryology of Mollusca. pp.155-180 in: M. FLORKIN and B.T. SCHEER, eds. *Chemical Zoology*, Vol. VII, Mollusca. Academic Press, New York.

RAVEN, C.P. & H. KLOMP. 1946. The osmotic properties of the egg of *Limnaea stagnalis* L. *Proc. K.ned. Akad. Wet. Amsterdam* 49: 101-109.

RAVEN, C.P., J.J. BEZEM & J. ISINGS. 1952. Changes in the size relation between macromeres and micromeres of *Lymnaea stagnails* under the influence of lithium. *Proc. K. ned. Akad. Wet. Amsterdam* 55C: 248-258.

ROSS, J.F. & A.D. HARRISON. 1977. Effects of environmental calcium deprivation on the egg masses of *Physa marmorata* Guilding (Gastropoda: Physidae) and *Biomphalaria glabrata* Say (Gastropoda: Planorbidae). *Hydrobiologia* 55: 45-48.

SAHA, T.C. & S.K. RAUT, 1992. Influence of temperature on hatching of eggs of some freshwater disease transmitting snails. *J. Taiwan Mus.* 45: 75-81.

SUBBA RAO, N.V. 1989. *Hand Book : Freshwater molluscs of India*. Zoological Survey of India, Calcutta, xxiii + 289 pp.

Catalogue of the Naticidae (Mollusca : Gastropoda) described by C. A. Récluz, including the location of the type specimens

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KEYWORDS. Naticidae, Récluz, type specimens.

ABSTRACT. This paper catalogues the Naticidae (Gastropoda) described by Constant A. Récluz, a French conchologist whose research interests focused on this family, as well as on the conchologically similar Neritidae. Récluz described about 100 species of Naticidae; type specimens for about 70 species are still extant. Most of the type specimens are in the Muséum d'Histoire Naturelle, Genève, but many of them are also in the British Museum (Natural History) or in the Muséum National d'Histoire Naturelle, Paris. Subsequent citations to these species (by various authors) are included.

RÉSUMÉ. Ce travail précise la localisation des spécimens-types de Naticidae décrits par Constant A. Récluz, conchyliologue français du 19e siècle ayant abondamment travaillé sur cette famille, ainsi que sur celle des Neritidae, qui leur ressemblent superficiellement. Récluz a décrit environ une centaine d'espèces de Naticidae; des spécimens-types ont été actuellement répertoriés pour environ 70 espèces; la plupart de ces types se trouvent au Muséum d'Histoire Naturelle de Genève, mais nombre d'entre eux sont également au British Museum (Natural History) et au Muséum National d'Histoire Naturelle de Paris. Les références bibliographiques de citations ultérieures de ces espèces (par Récluz lui-même ou par d'autres auteurs) sont également fournies.

INTRODUCTION

This paper is a companion to our earlier publication (KABAT & FINET, 1992) on the Neritidae (Archaeogastropoda) described by C.A. Récluz (1797/1798 ? - 1873), the French pharmacist and conchologist. Our previous paper discussed the history and vicissitudes of Récluz' mollusk collection, along with the nomenclatural practices of Récluz. The largest part of Récluz' collection now resides in the Muséum d'Histoire Naturelle of Genève, having been acquired as part of the Delessert collection (see also CAILLIEZ, 1995). For the Naticidae, some of Récluz' type specimens are now in the British Museum (Natural History), London, and in the Muséum National d'Histoire Naturelle, Paris. In particular, types of certain species described in the "Journal de Conchyliologie" are in the latter institution (FISCHER, 1950). According to the trustees of the Royal Belgian Institute of Natural Sciences, Brussels, no naticid type material of Récluz is in their holdings, but we have been unable to verify this personally in the Dautzenberg collection.

Récluz described numerous species in various molluscan families, but the majority of his new taxa were in the Neritidae (over 190 such) and the Naticidae (about 100). His last paper on the Naticidae (RÉCLUZ, 1856) provided an useful overview of the nomenclatural history of this family.

This paper delineates all the naticids described by Récluz, documents their known type specimens and includes selected subsequent references to these species, with emphasis on monographic treatments of the Naticidae. Many of his new species were not figured in the original; however, REEVE (1855; 1864) in the "Conchologia Iconica" (volume 9, *Natica* and volume 15, *Sigaretus*) provided figures of some of his taxa which may have been based on original material. Other nineteenth century references which treat some of Récluz' naticids include PHILIPPI (1849-1853) on *Natica* in the Martini-Chemnitz (2nd Edition); SOWERBY (1882; 1883) on *Natica* and *Sigaretus* in the "Thesaurus Conchyliorum"; and WEINKAUFF (1883) on *Sigaretus* in the Martini-Chemnitz (2nd Edition).

Significant twentieth century monographs of the Naticidae which we have referenced include CERNOHORSKY (1971) on the naticid fauna of Fiji; KILBURN (1976) on that of Southern Africa and Mozambique; MAJIMA (1989) on the Cenozoic naticids of Japan and MARINCOVICH (1977) on the Cenozoic naticids of the Northeastern Pacific. These authors, however, have generally not referred to the original type material of Récluz.

For each entry, we have included the original binomen, full publication data, size and locality (if given), together with any significant subsequent references. We have also made reference to an unpublished manuscript of Récluz, "Catalogue de la collection des familles des Néritides & Naticides du Cabinet de M. C. Récluz". Only a few of his naticid taxa have been critically restudied with type designations; we have indicated those when available. This paper should assist future researchers in their analyses of these taxa. No lectotype designations have been made in this catalogue, as it was not absolutely necessary to resolve systematic problems; we are thus leaving this open for eventual future research and revisions.

We emphasize that there are complex problems with the treatment of Naticidae by Récluz in the "Illustrations Conchyliologiques" of M. Chenu. This lavishly illustrated work appeared over a number of years, with certain sections never completed (SHERBORN and SMITH, 1911; JOHNSON, 1963) or even inconsistently written. Thus, for the genus *Natica* only "plates 2-4" were published; the text and plate 1 were never published (RECLUZ, 1843a). For the genus *Sigaretus* the text and plates were published over a two year period (RECLUZ, 1843b - 1844a) but there are internal inconsistencies in species names and in plate captions *versus* text references, as noted by KILBURN (1976 : 874-876).

Specifically, several problems with the Récluz treatment of *Sigaretus* in the "Illustrations Conchyliologiques" include : (1) when Récluz transferred an older species name (e.g., of Linnaeus or Gmelin) from *Helix* to *Sigaretus*, he gave the author as "*nobis*" (= new species) when in fact this is merely a new combination and not a new taxon. (2) For *Sigaretus*, he refers to a "Suppl. pl. 1, f. 1"; apparently this plate was never published (?), although it was subsequently cited by Récluz himself (1851b). (3) In the species catalogue of *Sigaretus* (RECLUZ, 1851b), there are frequent citations of the treatment in the "Illustr. Conchyl.", but also including obvious errors with regard to plate captions and even "new taxa" (in 1851b) based on figures in Chenu which are actually the basis of older names or even of new species in 1843b-1844a. (4) As mentioned in the previous paragraph, there are a number of errors or discrepancies in the 1843 section (pages 1-12, plates 1-4) *versus* the 1844 section (pages 13-24). We have attempted to reconcile these discrepancies, but some can only be solved by a subsequent restriction of types or localities in the course of revisionary studies [e.g., KABAT (1990 : 9) on *Sigaretus planatum* Récluz].

A number of species names listed herein were first published in synonymy. A name first published in synonymy may have been validated by use before 1961 (*ICZN* 11e), and the eventual specimen(s) cited with that name in the published synonymy, or associated with that name before it was published in synonymy, then represent(s) the type series of that nominal species-group taxon [*ICZN* 72b(iii)]. For most of the names first published in synonymy and listed herein, no evidence was found that they were made available by use prior to 1961; if it is discovered some day that a pre-1961 citation of such a name was made in a publication, then it revive the name, and further research could then deal with eventual type material, if any, whatever value that might have in a modern context (examples of *Natica amethystina, N. bifasciata, N. simioides* - see those names herein). The only example of a species first published in synonymy for which we could find a pre-1961 use, and for which material in the collections can be considered type material, is *Natica straminea* (see that name herein).

ABBREVIATIONS USED

BMNH : British Museum (Natural History), London.

MHNG : Muséum d'Histoire naturelle, Genève.

MNHN : Muséum National d'Histoire Naturelle, Paris.

ICZN : International Code of Zoological Nomenclature (1985).

JC : "Journal de Conchyliologie" [see WINCKWORTH (1936) and FISCHER-PIETTE (1937) for dates of publication].

PZSL : "Proceedings of the Zoological Society of London" [see DUNCAN (1937) for dates of publication].

MATERIAL AND METHODS

Reference to original description is given for each species, with the original locality or localities, as well as indications of the primary dimensions provided in the description. For the species described in *Natica*, the conventional dimensions are used : first dimension given is height, and second is width (at the aperture); for the shells of the genus *Sigaretus* (now *Sinum*), which are low spired and nearly auriform, first measurement is height, second is "length" or diameter at the aperture (usually the largest), and third is "width" or the diameter perpendicular to the second. A non-exhaustive synonymy and a few remarks are sometimes added. The type material available and verified is then mentioned; some specimens are of somewhat questionable type status, and are listed as doubtful or possible type specimens.

ALPHABETICAL LIST OF RECLUZ' NATICIDAE

(each species is listed by its original binomen)

achatensis, Natica Récluz *in* De Koninck, 1838 : 9 (not illustrated). Fossil, northern Belgium. 27 x 22 mm.

albula, Natica Récluz, 1851, *JC*, 2 (2) : 194-197. Wallis Island, Amboina, etc. 52-57 x 44-46 mm.

Reeve, 1855, pl. 6, fig. 23; = *Polinices mammilla* (Linnaeus, 1758), Kabat, herein.

19 possible syntypes, MHNG 20793 (formerly 985/427) ("Amboine, Timor, etc.").

amethystina, Natica Récluz, 1844, *PZSL*, 11 (130) : 211. "Lamarck's collection". Published in synonymy of *Natica violacea* Sowerby, 1825. The name does not seem to have been validated by use prior to 1961.

No material found in MHNG.

antillarum, Sigaretus Récluz, 1851, *JC*, 2 (2) : 185. Antilles. Refers to "pl. 3, f. 6,7" of Récluz *in* Chenu, 1843b.

Weinkauff, 1883 : 23-25, pl. 5, figs. 7-9; = *Sinum perspectivum* (Say, 1831), Kabat, herein.

aquensis, Sigaretus Récluz, 1851, *JC*, 2 (2) : 184. New name for *Sigaretus haliotoideus* var. a, b of Grateloup. Fossil, Dax, France.

areolata, Natica Récluz, 1844, *PZSL*, 11 (130) : 206. Capul Island, Philippines (H. Cuming); Amboina (Mus. Paris; Rumphius). 12-17 x 13-19 mm.

Philippi, 1852 : 67-68, pl. 11, fig. 2; Cernohorsky, 1971 : 182, figs. 26, 28-30; Kilburn, 1976 : 853, fig. 14; Majima, 1989 : 80-81, pl. 12, figs. 23-24 (*Tanea*). Valid species, Indo-Pacific.

3 syntypes, BMNH 1991066 and 3 possible syntypes, BMNH 1845.6.24.82-84 (Isle of Capul - H. Cuming collection).

8 original specimens, MHNG 993.129 ("var.", no locality) and 5 original specimens, MHNG 993.130 ("var. *cornea*", Amboine), not qualifying as syntypes as they are varieties [*ICZN* art. 72 (b) (i)].

bahiensis, Natica Récluz, 1850, *JC*, 1 (4) : 399-400. Bahia. 28 x 26 mm.

= *Polinices hepaticus* (Röding, 1798), Kabat, herein.

Holotype, MHNG 20794 (formerly 985/323).

bernardii, Natica Récluz, 1851, *JC*, 2 (2) : 197-199, pl. 5, fig. 1. "Gulf of Mexico ?" 31 x 28 mm. Is a *Mammilla* sp., from the Indo-Pacific.

bicincta, Natica Récluz, 1850, *JC*, 1 (4) : 395-396. Philippines. 39 x 33 mm.

= *Mammilla melanostomoides* (Quoy & Gaimard, 1833).

Holotype, MHNG 20795 (formerly 985/361).

bifasciata, Natica "Récluz" Reeve, 1855 : pl. 14, sp. 62. Published in synonymy of *Natica fulminea* (Gmelin, 1791). The name does not seem to have been validated by use prior to 1961. *Non Natica bifasciata* Gray, 1834, *nec* Stoppani, 1857.

bifasciatus, Sigaretus Récluz, 1851, *JC*, 2 (2) : 190-191, pl. 6, figs. 3-4. Sao Thome, West Africa. 5 x 17.5 x 13 mm.

Weinkauff, 1883 : 34, pl. 8, figs. 2,5.

1 syntype, MNHN ("Sénégal"); 1 syntype, MHNG 20824 (formerly 1152/23) ("St. Thomé, Afrique").

bourguignati, Natica Récluz, 1852, *JC*, 3 (2) : 170-171, pl. 7, fig. 8. Mozambique strait, Madagascar. 14-15 x 14 3/4 mm.

= *Natica fulminea* (Gmelin, 1791), West Africa, *fide* Reeve, 1855, pl. 14, sp. 62.

1 syntype, MHNG 20796 (formerly 993.128) ("Madagascar, Mozambique", 14 x 13 mm, but is not the specimen figured by Récluz). G. Mermod, former curator of mollusks at MHNG, noted (handwritten annotation with the specimens): "there were 2 traces on the board, but we found only 1 specimen in 1953, and this specimen does not seem to be the one figured by Récluz, J. Conch., pl. 7 fig. 8". The existing syntype is the northern Indian Ocean *Natica pulicaris* Philippi, 1842; the figured specimen may be a worn specimen of the tropical eastern Atlantic *Natica fulminea* (Gmelin, 1791); Récluz' original locality would then be erroneous.

broderipiana, Natica Récluz, 1844, *PZSL*, 11 (130) : 205. "Xipixapi, West Colombia" (Jipijapa, Ecuador), 16 fathoms (H. Cuming). 25.5 x 23.5 mm.

Philippi, 1853 : 134-135, pl. 17, fig. 5, pl. 19, fig. 2; Reeve, 1855 : pl. 15, fig. 66; Sowerby, 1883 : 80, pl. 7, fig. 91; Marincovich, 1977 : 399-402, pl. 40, figs. 6-7 (*Stigmaulax*).

3 syntypes, BMNH 1991091.

1 possible syntype, MHNG 20797 (formerly 1352/51) (21.5 x 21 mm; no locality) (an erroneous registration number ["1350/51"] was quoted in Marincovich, 1977).

buriasiensis, Natica Récluz, 1844, *PZSL*, 11 (130) : 212. Burias Island, Philippines, seven fathoms (H. Cuming). 11 x 11.5 mm.

Philippi, 1853 : 133, pl. 18, fig. 17; Reeve, 1855 : pl. 27, fig. 128; Sowerby, 1883 : 95, pl. 8, fig. 131.

2 syntypes, BMNH 1991065 and 2 possible syntypes, BMNH 1845.6.24.97-98 ("Philippines" - H. Cuming collection).

cailliaudi, Natica Récluz, 1850, *JC*, 1 (4) : 392-393, pl. 13, fig. 9. Amboina. 8.5 x 7 mm.

= *Natica pavimentum* Récluz, 1844, *fide* Reeve, 1855 : pl. 28, sp. 132.

2 syntypes, MHNG 20798 (formerly 1302/41) ("Amboine, Les Philippines [Rang]") [one figured, MHNG 1302/41/1 (Récluz, fig. 9)].

campeachiensis, Natica Récluz *in* Reeve, 1855 : pl. 1, fig. 1. Campeachy Bay, Gulf of Mexico.

= *Neverita duplicata* (Say, 1822), Kabat, herein.

3 syntypes, BMNH 1988039.

campechiensis, Natica Récluz *in* Chenu, 1843a : pl. 4, fig. 2. (name and figure only). See the preceding entry.

Sowerby, 1883 : 6, pl. 1, fig. 7.

candidissima, Natica Récluz, 1851, *JC*, 2 (1) : 87-88. Bahia, Brasil. 17-25 x 18-24 mm. *Non Natica candidissima* Le Guillou, 1842 (Vavao). Récluz' species was renamed *Natica jukesii* Reeve, 1855 (pl. 19, fig. 84); however, Reeve stated that this species came from North Australia (therefore Reeve's name is actually referrable to Le Guillou's species)!

= *Polinices porcellana* (d'Orbigny, 1840), Kabat, herein.

Lectotype, MNHN (selected by Fischer-Piette, 1950 : 12, as "holotype"); 5 possible paralectotypes, MHNG 20799 (formerly 1094/44).

cayennensis, Natica Récluz, 1850, *JC*, 1 (4) : 383-384, pl. 14, fig. 6. Cayenne, French Guiana. 29 x 23 mm. Valid species of *Stigmaulax*, Caribbean.

3 syntypes, MHNG 20800 (formerly 1152/21) [one figured, MHNG 1152/21/1 (Récluz, fig. 6)].

chemnitzii, Natica Récluz *in* Chenu, 1843a : pl. 3, fig. 4 (name and figure only).

See following entry. Junior homonym (*non Natica chemnitzii* Pfeiffer, 1840). Is probably *Neverita didyma* (Röding, 1798), but Récluz' species cannot be identified with certainty.

1 possible syntype, MHNG 20801 (formerly 993.127) (no locality; 55.2 mm x 55.5 mm; possibly the specimen figured in Chenu, pl. 3 fig. 4).

chemnitzii, Natica Récluz *in* Reeve, 1855 : pl. 2, fig. 7. Locality ? See preceding entry.

Chenu, 1859 : 214, fig. 1171.

2 syntypes, BMNH 1991087 (no locality - H. Cuming collection).

cincta, Natica Récluz, 1850, *JC*, 1 (4) : 384-385, pl. 14, fig. 7. Malabar. 17 x 15 mm. *Non Natica cincta* Phillips, 1829.

= *Natica pulicaris* Philippi, 1842.

2 possible syntypes, MHNG 20802 (formerly 1299/93) (no locality), the largest (17 mm x 16 mm) being probably that figured by Récluz.

clathratus, Sigaretus Récluz *in* Chenu, 1843b : 3, 12-13, pl. 1, figs. 12a-f. Replacement name for *Sigaretus canaliculatus, sensu* Defrance, *non* Sowerby, 1823.

colliei, Natica Récluz, 1844, *PZSL*, 11 (130) : 206-207. Swan River, Australia. 14 x 15 mm.

Philippi, 1852 : 70-71, pl. 11, fig. 6; Reeve, 1855 : pl. 24, fig. 112; Sowerby, 1883 : 80, pl. 9, figs. 142-144.

3 syntypes, BMNH 1991072 (Swan River); 3 original specimens, BMNH 1991073 ("var." from Isle Ticao on reefs), not qualifying as syntypes as they are varieties [*ICZN* art. 72 (b) (i)].

columnaris, Natica Récluz, 1850, *JC*, 1 (4) : 394-395. Manila, Philippines. 34 x 40 mm.

Reeve, 1855, pl. 5, fig. 19; Sowerby, 1883 : 78, pl. 3, fig. 37; = *Polinices peselephanti* (Link, 1807), *fide* Majima, 1989 : 46.

3 possible syntypes, BMNH 1845.6.24.7-8 (Philippines - H. Cuming collection).

crenata, Natica Récluz, 1853, *JC*, 4 (3) : 320, pl. 7, figs. 4, 5. Philippines. 28 x 27 mm. *Non Natica crenata* Zekeli, 1852, *nec* Conrad, 1860.

cumingiana, Natica Récluz, 1844, *PZSL*, 11 (130) : 210. Cayo Island, Philippines. 46 x 43 mm.

Philippi, 1852 : 47, pl. 7, fig. 4; Reeve, 1855, pl. 4, fig. 13; Sowerby, 1883 : 83, pl. 3, fig. 31.

3 syntypes, BMNH 1991088.

cuvierianus, Sigaretus Récluz *in* Chenu, 1844a : 18, pl. 3, fig. 2. Malaysia and Java.

Reeve, 1864 : pl. 3, fig. 12; Sowerby, 1882 : 41, pl. 441, fig. 6; Weinkauff, 1883 : 29-30, pl. 7, figs. 1-3.

2 syntypes, MHNG 20825 (formerly 1152/24) ("Java").

delessertiana, Natica Récluz *in* Chenu, 1843a : pl. 4, figs. 5-6 (name and figure only).

= *Neverita duplicata* (Say, 1822).

Possible syntypes, MHNG 20803 (formerly 1300/47) (2 specimens; probably the figured specimens) and MHNG 20804 (formerly 1300/48) (2 specimens) ("Hab. la Louisiane sur les bords du Missisipi, Marguier").

delessertii, Sigaretus Récluz *in* Chenu, 1843b : 5, 6, pl. 3, fig. 8; 1844a : 21-22. Sumatra.

Récluz, 1851, *JC*, 2 (2) : 185; Chenu, 1859 : 216, fig. 1186; Reeve, 1864 : pl. 2, fig. 10; Sowerby, 1882 : 41, pl. 441, figs. 14, 20-22; Weinkauff, 1883 : 21-22, pl. 4, figs. 4-6; Kilburn, 1976 : 876, fig. 25. [*fide* Kilburn, Reeve's reference is to *Sinum laevigatus* (Lamarck, 1822)].

4 syntypes, MHNG 20826 (formerly 1152/25) ("Ile Lombok").

deshayesianus, Sigaretus Récluz *in* Chenu, 1843b : 6; 1844a : 22, "pl. suppl. 1, fig. 1" (never published). Replacement name for *Sigaretus haliotoideus, sensu* Deshayes, *non* Linnaeus, 1758. Fossil, Morée [France].

desmoulinsianus, Sigaretus Récluz, 1851, *JC*, 2 (2) : 182. Mainot (we have not been able to identify this type locality). *Nude name*.

draparnaudii, Natica Récluz, 1851, *JC*, 2 (2) : 198-199, pl. 5, fig. 11. Gulf of Mexico ? 35 x 32 mm.

Reeve, 1855 : pl. 11, fig. 44; Sowerby, 1883 : 77-78, pl. 7, fig. 84; = *Polinices aurantius* (Röding, 1798), from the Indo-Pacific [some authors thought it to be the Caribbean *Polinices hepaticus* (Röding, 1798)].

Holotype, MNHN.

dubia, Natica Récluz, 1844, *PZSL*, 11 (130) : 209-210. Chili ? (H. Cuming). 37-39 x 36-37 mm. *Non Natica dubia* Römer, 1836.

Philippi, 1852 : 61-62, pl. 10, fig. 3; Reeve, 1855 : pl. 10, fig. 41; Sowerby, 1883 : 86, pl. 5, fig. 56.

2 syntypes, BMNH 1991095.

elegans, Natica Récluz, 1850, *JC*, 1 (4) : 381-382, pl. 13, fig. 4. Locality unknown. 24 x 24 mm. *Non Natica elegans* J. Sowerby, 1836, *nec* Kacharava, 1960.

= *Natica picta* Récluz, 1844, *fide* Reeve, 1855, pl. 15, sp. 67.

Holotype (figured), MHNG 20805 (formerly 1302/55) ("Manille").

elenae, Natica Récluz, 1844, *PZSL*, 11 (130) : 205-206. St. Elena, West Colombia (Ecuador), six fathoms (H. Cuming). 23 x 24 mm.

Philippi, 1853 : 135-136, pl. 19, fig. 4; Reeve, 1855 : pl. 21, fig. 94; Sowerby, 1883 : 79, pl. 9, fig. 150; Marincovich, 1977 : 402-404, pl. 40, figs. 8, 9 (*Stigmaulax*); Finet, 1994 : 31.

3 syntypes, BMNH 1964441.

euzona, Natica Récluz, 1844, *PZSL*, 11 (130) : 204. Cagayan, Misamis Province, Mindanao Island, Philippines; also from Capul Island, Philippines (H. Cuming). 14.5 x 16 mm.

Récluz, 1850, *JC*, 1 (4) : 381, pl. 14, fig. 3; Philippi, 1853 : 147; Kilburn, 1976 : 854-855, fig. 13 (*Tanea*); = *Natica picta* Récluz, 1844, *fide* Reeve, 1855 : pl. 15, sp. 67.

1 syntype, MHNG 20806 (formerly 1302/56) ("Hab. La Chine - Philippines [Cuming]"); type material from other locality not found.

fanel, Natica "Adanson" Récluz, 1844, *PZSL*, 11 (130) : 207. "Zanzibar" (Cuming).

A West African species. *Non Natica fanel* (Röding, 1798); a validation of the prelinnaean *Natica* "Le Fanel" Adanson, 1757 was that of RÉCLUZ (1844 : 207), using the name *Natica variolaria* Récluz, 1844; but an yet earlier validation was made by DE BLAINVILLE (1825 : 249), using the name *Natica multipunctata* (*non Natica multipunctata* Wood, 1842 !) (see VERBERCKT, 1995 : 113); REEVE (1855 : pl. 19, fig. 83) also renamed this species *Natica adansoni*, an unnecessary replacement name (*non Natica adansoni* Philippi, 1849 !).

Philippi, 1850 : 16-17, pl. 2, figs. 6-8; 1852 : 7, pl. 11, fig. 18; Verberckt, 1995 : 113.

3 syntypes, BMNH 1991075.

flemingiana, Natica Récluz, 1844, *PZSL*, 11 (130) : 209. Sorsogon, Luzon Island, Philippines (H. Cuming). 30 x 26 mm.

Récluz, 1852, *JC*, 3 (2) : 171-172, pl. 7, fig. 2, 2a; Philippi, 1853 : 126-127, pl. 18, fig. 7; Reeve, 1855 : pl. 18, fig. 80; Sowerby, 1883 : 86, pl. 7, fig. 99; Cernohorsky, 1971 : 193-194, figs. 46, 51-53.

2 syntypes, MHNG 20807 (formerly 1300/41) (30 mm x 26 mm; 30 mm x 27 mm) ("Ile Luçon, Tahiti"); 2 possible syntypes, BMNH 1991100 (the original label indicates that there were originally 4 specimens; neither of these 2 remaining specimens is that figured by Reeve (sp. 80), nor do they fit Récluz' measurements).

francisca, Natica "Récluz" Reeve, 1855, pl. 27, fig. 127. "appears to be a variety of the British *N. nitida*".

Sowerby, 1883 : 90, pl. 9, fig. 162 (full species).

3 syntypes, BMNH 1996082 ("Seas of Europe" - H. Cuming collection).

fulgurans, Natica Récluz, 1844, *PZSL*, 11 (130) : 206. Senegal (Mme Dupont). 22 x 20 mm.

Philippi, 1852 : 65, pl. 10, fig. 12; 1853 : 135, pl. 19, fig. 3; Reeve, 1855 : pl. 22, fig. 100; Sowerby, 1883 : 80, pl. 8, fig. 123.

3 syntypes, BMNH 1991076.

funiculata, Natica Récluz, 1850, *JC*, 1 (4) : 400-401. Philippines or Coromandel. 33 x 37 mm.

= *Polinices columnaris* (Récluz, 1850), Indo-Pacific.

1 syntype, MHNG 20808 (formerly 1300/57) (no locality; 33.0 x 33.2 mm); 3 syntypes, MHNG 20809 (formerly 1300/58) ("Philippines").

fuscata(e), Natica Récluz, 1844, *PZSL*, 11 (130) : 210, 211. The first citation as a variety "junior" of *Natica cumingiana* Récluz, 1844; the second citation as a new name for *Natica mamillaris* Lamarck, 1822.

= *Polinices hepaticus* (Röding, 1798), Kabat, herein.

gallapagosa, Natica Récluz, 1844, *PZSL*, 11 (130) : 213. Albemarle Island, Galapagos (H. Cuming) (no size given).

Philippi, 1853 : 131, pl. 18, fig. 12; Reeve, 1855 : pl. 19, fig. 86; Sowerby, 1883 : 89, pl. 7, fig. 95; = *Polinices otis* (Broderip and Sowerby, 1829), an eastern Pacific species not occurring in the Galapagos, *fide* Marincovich, 1977 : 255 (type locality by Récluz would then be erroneous); see also Finet, 1985 : 35, & Finet, 1994 : 130.

2 syntypes, BMNH 1964435 (see also Nesbitt & Pitt, 1986 : 295).

gambiae, Natica Récluz, 1844, *PZSL*, 11 (130) : 207. River Gambia (H. Cuming). 27 x 25 mm.

Reeve, 1855 : pl. 23, fig. 105; Sowerby, 1883 : 94, pl. 4, fig. 49.

globosus, Sigaretus Récluz *in* Chenu, 1844a : 13-14, pl. 1, figs. 9c-d. Fossil, France.

gouldianus, Sigaretus Récluz, 1851, *JC*, 2 (2) : 187-188, pl. 6, figs. 5, 6. Fossil, near Paris. 6 x 10 x 9 mm.

gracilis, Natica Récluz, 1850, *JC*, 1 (4) : 387, pl. 14, fig. 11. Philippines. 10 x 9 mm. *Non Natica gracilis* Klipstein, 1845, *nec* Sowerby, 1883.

Holotype, MNHN.

gratelupianus, Sigaretus Récluz *in* Chenu, 1843b : 9, pl. 1, fig. 6a-b. Fossil, France.

gualteriana, Natica Récluz, 1844, *PZSL*, 11 (130) : 208. Sual, Pangasinan Province, Luzon Island, Philippines, 5-7 fathoms. 12.5 x 12 mm. Type specimen was not figured by Reeve.

Récluz, 1850, *JC*, 1 (4) : 396-397; Philippi, 1852 : 71-72, pl. 11, fig. 8; Récluz *in* Reeve, 1855 : pl. 25, fig. 114; Sowerby, 1883 : 81-82, pl. 9, fig. 152; Kilburn, 1976 : 835-837; Majima, 1989 : 77, pl. 12, fig. 21, text-figs. 15.53-4.

3 possible syntypes, BMNH 1845.6.24.101-103 ("Philippines" - H. Cuming collection)

gualtieriana, Natica "Récluz" Couturier, 1907 (*JC*, 55 : 165). Emendation for *Natica gualteriana* Récluz, 1844.

Cernohorsky, 1971 : 180-182, figs. 21-25. Valid species, Indo-Pacific.

gualtierianus, Sigaretus Récluz, 1851, *JC*, 2 (2) : 185. Based on Martini & Chemnitz, 1769, *Conch. Cab.*, 1, pl. 16, fig. 152.

= *Sigaretus planulatus* Récluz *in* Chenu, 1843.

haneti, Natica Récluz, 1850, *JC*, 1 (4) : 389-391, pl. 13, figs. 6-7. Bahia (Ecuador). 38 x 34 mm.

= *Natica elenae* Récluz, 1844, *fide* Reeve, 1855 : pl. 21, fig. 94.

Lectotype, MNHN (selected by Fischer-Piette, 1950 : 12, as "holotype"); possible paralectotype, MHNG 20810 (formerly 1300/66).

intermedia, Natica Récluz *in* Chenu, 1843a : pl. 2, fig. 10, pl. 3, figs. 1-3 (name and figure only). *Non Natica intermedia* Deshayes, 1832, *nec* Philippi, 1836.

italicus, Sigaretus Récluz *in* Chenu, 1843b : 4, pl. 4, fig. 8; 1844a : 22. Replacement name for *Helix haliotoidea, sensu* Brocchi, *non* Linnaeus, 1758. Fossil, Italy.

junior, Sigaretus Récluz, 1851, *JC*, 2 (2) : 184. Refers to "pl. 4, f. 3a, b" of Récluz *in* Chenu, 1843b; this is actually the type figure of *Sigaretus maculatus* Say!

An objective junior synonym of *Sinum maculatum* (Say, 1831).

lacteus, Sigaretus Récluz, 1851, *JC*, 2 (2) : 186-187, pl. 6, fig. 12. "Amboine ?". 13 x 24 x 33 mm.

Weinkauff, 1883 : 33-34, pl. 8, figs. 1, 3.

Holotype, MHNG 20827 (formerly 1152/26) (no locality).

laevigatus, Sigaretus "Récluz" Sowerby, 1882 : 41, pl. 441, figs. 12-13. Error for *Sigaretus laevigatus* Lamarck, 1822.

lamarckiana, Natica Récluz *in* Reeve, 1855 : pl. 2, fig. 6. Locality unknown. *Non Natica lamarckiana* Leach *in* Gray, 1852.

= *Neverita didyma* (Röding, 1798), *fide* Kilburn, 1976 : 860.

4 syntypes, BMNH 1991092 (no locality).

lamarckianus, Sigaretus Récluz *in* Chenu, 1843b : 7, pl. 1, figs. 5a-b. Philippines. (error in figure caption as "*mamillaris* R."; pl. 3, fig. 2 labelled as "*lamarckianus*", but is *delessertii* Récluz).

Chenu, 1859 : 216, fig. 1184; Weinkauff, 1883 : 40-41, pl. 9, figs. 8, 11.

= *Eunaticina linnaeana* (Récluz, 1843), *fide* Kilburn, 1976 : 870.

3 probable syntypes, MHNG 20828 (formerly 1152/27) ("Les Philippines").

lamarckii, Natica Récluz *in* Chenu, 1843a, pl. 2, figs. 1-4 (name and figure only). *Non Natica lamarckii* Leach, 1847. See *Natica lamarckiana* Récluz *in* Reeve, 1855.

largillierti, Natica Récluz, 1852, *JC*, 3 (4) : 408-409, pl. 12, fig. 1. Stomachs of codfish, Banks, "Terre-Neuve". 32 x 26 mm.

= *Bulbus fragilis* (Leach, 1819), Kabat, herein.

levesquei, Sigaretus Récluz *in* Deshayes, 1864, text vol. 3 : 89; plates vol. 2 : pl. 69, figs. 23-26. Cuise-la-Motte, Laon, Laversine [France] ("sables inférieurs").

linneanus, Sigaretus Récluz *in* Chenu, 1843b : 6, 8, pl. 1, fig. 4a-b. Malaysia.

Récluz, 1851, *JC*, 2 (2) : 181; Weinkauff, 1883 : 37-38, pl. 9, figs. 2,5; Kilburn, 1976 : 870-871, fig. 21; Majima, 1989 : 69, figs. 15, 37, 23.2a-d (*Eunaticina*).

3 syntypes, MHNG 20829 (formerly 1152/28) ("Madagascar"). As already noted by G. Mermod, former curator of mollusks at MHNG (handwritten annotation with the specimens), Récluz, as well as other authors, cited Malaysia as locality; however, Récluz mentioned "Madagascar" on his label, probably in error.

listerianus, Sigaretus Récluz *in* Chenu, 1843b : 3. Error for *Sigaretus listerii* Récluz *in* Chenu, 1843.

listerii, Sigaretus Récluz *in* Chenu, 1843b : 1; 1844a : 15-16, pl. "3" [2], fig. 2. New Holland. (on page 3, as "*listerianus*").

Holotype, MHNG 20830 (formerly 1152/29) ("Australie ?").

maheense, Natica "Récluz" Reeve, 1855 : pl. 14, fig. 58 (Mahe, Seychelles). *Non Natica mahesiensis* Dufo, 1840. Reeve's species renamed *Natica seychellium* Watson, 1886 (Chall. Rept., pp. 434-435).

Sowerby, 1883 : 81, pl. 4, fig. 40 (as "*maheensis*").

3 syntypes, BMNH 1991036.

malabarica, Natica Récluz, 1850, *JC*, 1 (4) : 393-394. Mahé, Malabar Islands. 14 x 15 mm.

mammilaris, Sigaretus Récluz *in* Chenu, 1843b : 8-9, pl. 1, figs. 3a-b. A replacement name for *Natica cancellata* Swainson, 1840, *non* Lamarck, 1822, *nec* Hermann, 1781.

moquiniana, Natica Récluz, 1853, *JC*, 4 (2) : 154-156, pl. 5, figs. 9-10. Locality unknown; possibly Pacific Ocean. 16 x 14 mm.

Holotype, MNHN.

neritoideus, Sigaretus Récluz *in* Chenu, 1843b : 3. Replacement name for *Sigaretus concavus sensu* Sowerby, *non* Lamarck, 1822. *Non Sigaretus neritoideus* (Linnaeus, 1758).

ochrostoma, Natica Récluz, 1850, *JC*, 1 (4) : 391, pl. 13, fig. 10. Locality unknown. 20 x 16 mm.

= *Polinices lacteus* (Guilding, 1834), Kabat, herein.

Holotype, MHNG 20811 (formerly 1300/97) (no locality).

opaca, Natica Récluz, 1851, *JC*, 2 (2) : 199-200. Bourbon Island ? 35-37 x 28-32 mm. The type locality "Bourbon Isl." (= Réunion Isl.) can be considered equivalent to the "Seychelles Islands" (broadly defined).

= *Mammilla melanostoma* (Gmelin, 1791), *fide* Reeve, 1855, pl. 8.

2 possible syntypes, MHNG 20812 (formerly 1302/9) (no locality); 2 possible syntypes, MHNG 20813 (formerly 1302/12) (loc. : "Les Séchelles").

2 possible syntypes BMNH 1996080 ("Seychelles" - H. Cuming collection).

pallium, Natica Récluz, 1850, *JC*, 1 (4) : 397-399. Poulo-Pinang. 55 x 47 mm.

Récluz, 1851, *JC*, 2 (2) : 201-202, pl. 6, fig. 9; = *Natica cumingiana* Récluz, 1844, *fide* Reeve, 1855, pl. 4.

panamaensis, Natica Récluz, 1844, *PZSL*, 11 (130) : 208-209. Panama, ten fathoms (H. Cuming). 44-54 x 40-47 mm.

Philippi, 1852 : 45-46, pl. 7, fig. 3; Reeve, 1855, pl. 3, fig. 11; Sowerby, 1883 : 86, pl. 2, fig. 18 (as "*panamensis*"); Marincovich, 1977 : 252-253, pl. 22, figs. 5-7 (*Polinices*).

3 syntypes, BMNH 1964446; 1 possible syntype, BMNH 1845.6.24.52 (Panama - H. Cuming collection).

pavimentum, Natica Récluz, 1844, *PZSL*, 11 (130) : 208. Ticao Island, Philippines (H. Cuming). 10 x 9 mm. (*Non Cochlis pavimentum* Röding, 1798 : 147).

Philippi, 1853 : 132, pl. 18, fig. 16; Reeve, 1855, pl. 28, fig. 132.

3 syntypes, BMNH 1991074.

perspicua, Natica Récluz, 1850, *JC*, 1 (4) : 379-380, pl. 14, figs. 1-2. Philippines. 36 x 29 mm. *Non Natica perspicua* Pictet and Roux, 1849 (fossil, Switzerland).

Reeve, 1855 : pl. 4, fig. 12; Chenu, 1859 : 215, fig. 1177; Sowerby, 1883 : 87, pl. 6, fig. 70 [*fide* Marincovich, 1977 : 255, Reeve & Sowerby's figures are of *Polinices otis* (Broderip and Sowerby, 1829), an Eastern Pacific species].

2 syntypes, MHNG 20814 (formerly 1302/43) ("Nouvelle-Hollande") [one figured, MHNG 1302/43/1 (Récluz, figs. 1-2)].

petitianus, Sigaretus Récluz *in* Chenu, 1843b : 12, pl. 2, figs. 1, 2. Malaysia and Java.

petitveriana, Natica Récluz *in* Chenu, 1843a : pl. 2, figs. 5-9 (name and figure only). See the following entry.

petiveriana, Natica Récluz *in* Reeve, 1855 : pl. 5, fig. 17. Catbalonga, Samar Island, Philippines.

Chenu, 1859 : 214, fig. 1169; = *Neverita didyma* (Röding, 1798).

3 syntypes, BMNH 1991090 (Catbalonga, Samar, Philippines); 2 possible syntypes, BMNH 1845.6.24.5-6 (Philippines - H. Cuming collection).

2 possible syntypes, MHNG 20815 (formerly 1302/52) (no locality).

philippiana, Natica Récluz *in* Chenu, 1843a : pl. 4, fig. 4 (name and figure only). See the following entry.

philippiana, Natica Récluz *in* Reeve, 1855 : pl. 11, sp. 45. Alexandria, Egypt.

Chenu, 1859 : 214, fig. 1172;

2 possible syntypes BMNH 1845.6.24.60-61 (Alexandria - H. Cuming collection), neither of them however matching Reeve's fig. 45.

picta, Natica Récluz, 1844, *PZSL*, 11 (130) : 204. Basey, Island of Samar, Philippines (H. Cuming). 26 x 27.5 mm.

Philippi, 1852 : 69-70, pl. 11, fig. 5; Reeve, 1855 : pl. 15, fig. 67; Sowerby, 1883 : 84, pl. 8, fig. 120.

3 syntypes, BMNH 1991068; 3 possible syntypes, BMNH 1845.6.24.47-49 (Philippines - H. Cuming collection).

pisiformis, Natica Récluz, 1844, *PZSL*, 11 (130) : 213. Valparaiso, Chile, 45 fathoms (H. Cuming). 5-6 x 5 - 5 3/4 mm.

Philippi, 1853 : 136-137, pl. 19, fig. 5; Reeve, 1855 : pl. 29, fig. 135; Sowerby, 1883 : 91, pl. 9, fig. 163.

4 syntypes, BMNH 1996079.

planatus, Sigaretus Récluz *in* Chenu, 1843b : 1, 6 (on plate 3 and page 21, as "*planulatus*", see next entry).

planulatus, Sigaretus Récluz *in* Chenu, 1843b : pl. 3, fig. 4; 1844a : 21. Mahe, Seychelles. Emendation for *Sigaretus planatus* Récluz *in* Chenu, 1843.

Récluz, 1851b : 185 (loc. : "Philippines"); Reeve, 1864 : pl. 2, fig. 7; Sowerby, 1882 : 42, pl. 442, figs. 29-30; Weinkauff, 1883 : 15-16, pl. 2, figs. 7-9, pl. 4, figs. 10-12; Kilburn, 1976 : 874-876, figs. 23-24 (*Sinum*); Kabat, 1990 : 6, 9.

7 syntypes, MHNG 20831 (formerly 1152/30).

powisiana, Natica Récluz, 1844, *PZSL*, 11 (130) : 210-211. Moluccas (H. Cuming). 35-40 x 35-44 mm.

Philippi, 1852 : 46, pl. 7, fig. 4; Reeve, 1855 : pl. 6, fig. 22; Sowerby, 1883 : 83, pl. 3, fig. 32; = *Neverita peselephanti* (Link, 1807), *fide* Kilburn, 1976 : 857.

3 syntypes, BMNH 1991093; 3 syntypes, BMNH 1991094.

priamus, Natica Récluz, 1844, *PZSL*, 11 (130) : 213-214. Moluccas (H. Cuming); Isle of France (M. le Colonel Matthieu, Mus. Paris). 42 x 40 mm.

Philippi, 1853 : 124, pl. 18, fig. 2; Reeve, 1855 : pl. 9, fig. 36; Sowerby, 1883 : 98, pl. 2, fig. 23; Kilburn, 1976 : 861 (*Mammilla*).

5 syntypes, BMNH 1991079 (Moluccas, H. Cuming coll.) (two species combined in type lot).

puncticulata, Natica Récluz, 1850, *JC*, 1 (4) : 391-392. Locality unknown. 17 x 15 mm.

3 syntypes, MHNG 20816 (formerly 1302/65) ("Madagascar") (probably two species in the lot).

pyriformis, Natica Récluz, 1844, *PZSL*, 11 (130) : 211. Ilo-Ilo, Panay Island, Philippines (H. Cuming); and Huan River, Australia, 10 fathoms. (no sizes given).

Philippi, 1852 : 60, pl. 9, fig. 8; Reeve, 1855 : pl. 5, fig. 16; = *Polinices mammilla* (Linnaeus, 1758), Kabat, herein.

3 syntypes, BMNH 1991089 (Isle of Panay - H. Cuming collection); 3 possible syntypes, BMNH 1845.6.24.56-58 (Philippines - H. Cuming collection).

2 possible syntypes, MHNG 20817 (formerly 1301/31); 3 possible syntypes MHNG 20818 (formerly 1301/36); (both from "Les Philippines").

"***raynaudiana, Natica*** Récluz" Reeve, 1855 : pl. 13, fig. 56; Sowerby, 1883 : 90, pl. 7, fig. 88. See the following entry.

raynoldiana, Natica Récluz, 1844, *PZSL*, 11 (130) : 212. "Zanzebar", East Africa; Cagayan, Misamis Province, Mindanao Island, Philippines (H. Cuming); Trincomalee, Ceylon.

= *Natica arachnoidea* (Gmelin, 1791), *fide* Philippi, 1850 : 26, and Cernohorsky, 1971 : 177.

3 syntypes, BMNH 1991077 (Zanzebar); 3 original specimens, BMNH 1991078 and 4 other possible original specimens, BMNH 1845.6.24.62-4 (all "var. β" from Cagayan, Philippines), not qualifying as syntypes as they are varieties [*ICZN* art. 72 (b) (i)].

1 syntype, MNHN (Zanzibar, M. Raynaud), *fide* V. Heros (*in litt.*, 1995); other original material, MNHN ("var. γ" from Trincomalee), not qualifying as type material, being a mere variety.

5 original specimens, MHNG 1300/54 ("Trinquemalé, Baie de Ceylan [M. Reynaud]"), corresponding to the "var. γ" and thus not qualifying as syntypes.

sagittifera, Natica Récluz, 1852, *JC*, 3 (2) : 168-170, pl. 8, figs. 4, 5. Locality unknown. 16 x 15.5 mm.

= *Natica alapapilionis* (Röding, 1798).

5 possible syntypes, MHNG 20819 (formerly 1301/86).

salangonensis, Natica Récluz, 1844, *PZSL*, 11 (130) : 211. Salango, West Colombia [= Ecuador] (H. Cuming). 26 x 23 mm.

Philippi, 1853 : 131-132, pl. 18, fig. 13; = *Polinices otis* (Broderip and Sowerby, 1829), *fide* Marincovich, 1977 : 255.

Type material possibly in BMNH, but could not be found (1996).

samarensis, Natica Récluz, 1844, *PZSL*, 11 (130) : 214. Catbalonga, Samar Island, Philippines (H. Cuming). 33 x 25 mm.

Philippi, 1853 : 149-150; = *Mammilla simiae* (Deshayes, 1838), *fide* Cernohorsky, 1971 : 199.

sebae, Natica Souleyet *in* Récluz, 1844, *PZSL*, 11 (130) : 214 (figured in Voy. Bonite, pl. 35, figs. 6-7). St. Nicholas, Zebu Island, Philippines.

Souleyet, 1852 : 579-580; Kilburn, 1976 : 861-862, fig. 17d (type locality designated by Kilburn as "Manilla, Philippines"); = *Helix mamillaris* Born, 1780 (p. 380, pl. 15, figs. 13-14), *non* Linnaeus, 1767. The *Natica sebae* "Récluz" of Philippi (1853 : 123, pl. 18, fig. 1), Reeve, 1855 (pl. 17, fig. 74 and Sowerby (1883 : 97, pl. 457, fig. 79) was renamed *Polinices* (*Mammilla*) *syrphetodes* Kilburn, 1976 (pp. 862-863, figs. 17a-c, 20a).

senegalensis, Natica Récluz, 1850, *JC*, 1 (4) : 382-383, pl. 14, fig. 5. Senegal. 25 x 19 mm.

= *Natica fulminea* (Gmelin, 1791), *fide* Reeve, 1855 : pl. 14, sp. 62.

simioides, Natica "Récluz" Reeve, 1855 : pl. 17, sp. 76. Published in synonymy of *Natica simiae* Deshayes, 1838. The name does not seem to have been validated by use prior to 1961.

sinuatus, Sigaretus Récluz, 1851, *JC*, 2 (2) : 189-190, pl. 6, figs. 12-14. Red Sea. 13 x 23 x 29 mm. *Non Sigaretus sinuatus* Swainson, 1837 (*nomen nudum*).

Weinkauff, 1883 : 35-36, pl. 8, figs. 7-9.

Holotype, MHNG 20832 (formerly 1152/31) (no locality).

souleyetiana, Natica Récluz, 1850, *JC*, 1 (4) : 385-386, pl. 14, fig. 8. "Océan Pacifique?". 17 x 15 mm.

Lectotype, MNHN (selected by Fischer-Piette, 1950 : 12, as "holotype") and 2 paralectotypes, MNHN (two "jeunes") (= *Tanea zelandica*); 3 possible paralectotypes, MHNG 20820 (formerly 993.208) ("Bahia") (not conspecific : smaller two = *N. canrena*; largest = *N. marochiensis* ?).

straminea, Natica Récluz, 1844, *PZSL*, 11 (130) : 211. Published in synonymy *of Natica aurantia* Lamarck, 1822 ("Philippines, found on the reefs" - H. Cuming) and validated by use prior to 1961 (see TRYON, 1886 : 42, pl. 15 fig. 40, as a variety). *Non Natica straminea* Philippi, 1852 : 113, pl. 16, fig. 3.

Récluz, 1851, *JC*, 2 (2) : 201; Chenu, 1859 : 215, fig. 1176; = *Polinices aurantius* (Röding, 1798), *fide* Cernohorsky, 1971 : 194.

2 possible syntypes BMNH 1845.6.24.43-44, being H. Cuming specimens from the Philippines and labelled "*straminea* Récluz", and thus specimens possibly associated with that name before it was published in synonymy by Récluz himself [*ICZN* 72b (iii)].

Other lots of specimens found in the Récluz collection of the MHNG, labelled "*straminea*", with an original label of Récluz, are not accorded type status as their locality is either "Amboine, Java, Timor,...", i.e. the locality given by Récluz only for the specimens of the variety β in the MNHN ("Mus. Paris"), or another locality not cited in Récluz' publication.

sulphurea, Natica Récluz, 1844, *PZSL*, 11 (130) : 211. Published in synonymy of *Natica aurantia* Lamarck, 1822.

= *Polinices aurantius* (Röding, 1798), *fide* Cernohorsky, 1971 : 194.

taslei, Natica Récluz, 1853, *JC*, 4 (1) : 53, pl. 2, figs. 11, 12. Mazatlan, Mexico.

= *Natica broderipiana* Récluz, 1844, *fide* Reeve, 1855 : pl. 15, sp. 66.

Lectotype, MNHN (selected by Fischer-Piette, 1950 : 14, as "holotype") and 1 paralectotype, MNHN.

tenuis, Natica Récluz, 1850, *JC*, 1 (4) : 388, pl. 12, fig. 7. Valparaiso, Chile. 24 x 19 mm.

Holotype, MHNG 20821 (formerly 1302/94) (24.1 mm x 19.1 mm; no locality); one additional specimen, MHNG 1302/93, corresponding to "var. ß" and hence not having type status [*ICZN* 72 (b)(i)].

tournefortii, Natica Récluz, 1850, *JC*, 1 (4) : 396. Seychelles. 25 x 21 mm.

trifasciata, Natica cruentata var. Récluz, 1844, *PZSL*, 11 (130) : 212. A replacement name for *Natica arachnoidea, sensu* Lamarck, *non* Gmelin, 1791.

turonicus, Sigaretus Récluz *in* Chenu, 1843b : 4, pl. 4, figs. 7a-b; 1844a : 23-24. Fossil, Italy. Replacement name for *Sigaretus haliotoidea sensu* Dujardin, *non* Linnaeus, 1758. Emended to *Sigaretus turonensis* : Peyrot, 1938, Actes Soc. Linn. Bordeaux 89 (Suppl.): 82.

unifasciatus, Sigaretus Récluz *in* Chenu, 1843a : 5-6; 1844a : 17-18, pl. 3, fig. "4" [1]. Philippines.

Sowerby, 1882 : 42, pl. 442b, fig. 52; Weinkauff, 1883 : 25-26, pl. 4, fig. 11, and p. 35, pl. 8, fig. 12.

1 syntype MHNG 20833 (formerly 1152/32) (no locality); ? 1 doubtful syntype, MHNG 20834 (formerly n° "458/4").

variabilis, Natica Récluz *in* Reeve, 1855 : pl. 23, fig. 104. "probably from the Mediterranean".

Sowerby, 1883 : 95, pl. 9, fig. 135.

3 syntypes, BMNH 1996081 (no locality - H. Cuming collection).

variolaria, Natica Récluz, 1844, *PZSL*, 11 (130) : 207. See *Natica fanel*.

"***venustula, Natica*** Récluz" Sowerby, 1883 : 91, pl. 9, fig. 146. Error for *Natica venustula* Philippi, 1851.

virginea, Natica Récluz, 1850, *JC*, 1 (4) : 388-389, pl. 12, fig. 6. Realejos. 22 x 18 mm. *Non Natica virginea* Philippi, 1852.

= *Polinices uber* (Valenciennes, 1832), *fide* Marincovich, 1977 : 247 (Marincovich suggested that locality is probably in Nicaragua at 13° N).

Lectotype, MNHN (selected by Fischer-Piette, 1950 : 12, as "holotype") and 2 paralectotypes, MNHN; 2 possible paralectotypes, MHNG 20822 (formerly 1303/1/1-2) (no locality).

zanzebarica, Natica Récluz, 1844, *PZSL*, 11 (130) : 213. Zanzebar. 50 x 41 mm.

Philippi, 1853 : 125, pl. 18, fig. 3; Reeve, 1855, pl. 17, figs. 75; Sowerby, 1883 : 97, pl. 6, fig. 73; = *Mammilla sebae* Récluz, 1844, *fide* Kilburn, 1976 : 861.

3 syntypes, BMNH 1991099.

zonalis, Natica Récluz, 1850, *JC*, 1 (4) : 386-387, pl. 14, figs. 9, 10. Fiji. 17 x 14 mm.

Cernohorsky, 1971 : 187-188, figs. 37-40. Valid species, Indo-Pacific.

Holotype, MHNG 20823 (formerly 1152/22) (labelled "Iles Sandwich", likely erroneous, as type loc. is Fiji, not Hawaiian Islands).

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ADDENDUM TO OUR 1992 PAPER ON RÉCLUZ' NERITIDAE.

Nerita rangiana Récluz, 1841 was described as a new name for *Nerita viridis* Linné var. *major* "Rang, 1827". Dr. Philippe Bouchet has kindly provided us with a copy of the 1827 paper which was actually authored by Férussac. This varietal name was used on page 412 as "var. maj." from Madagascar. The specimens were collected by Rang, whose name was in the title ("... recueillies par M. Rang..."), thus resulting in some confusion by subsequent authors in thinking that Rang was the author of the paper.

REFERENCES

BLAINVILLE, de, H.M. 1825. Natica *(Malacoz.). Dictionnaire des Sciences naturelles.* F.G. Levrault, 34: 247-258.

CAILLIEZ, J.C. 1995. *Notice sur les collections malacologiques du Muséum d'Histoire naturelle de Genève*. Edited by the author; 49 pp. (distributed by the Museum of Natural History of Geneva, Switzerland).

CERNOHORSKY, W.O. 1971. The family Naticidae (Mollusca : Gastropoda) in the Fiji Islands. *Records of the Auckland Institute and Museum* 8: 169-208.

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CHENU, J.C. 1859-62. *Manuel de Conchyliologie*, Paris, Vol. 1, vii + 508 pp., 3707 figs. [1859]; Vol. 2, 327 pp., 1236 figs. [1862].

COUTURIER, M^al^. 1907. Etude sur les Mollusques Gastropodes recueillis par M. L.-G. Seurat dans les archipels de Tahiti, Paumotu et Gambier. *Journal de Conchyliologie* 55 (2): 123-178.

DESHAYES, G.P. 1856-65. *Description des Animaux sans Vertèbres découverts dans le Bassin de Paris...*, Baillière, Paris, 3 text vols. : 912, 968 & 658 pp.; 2 plates vols. : pls. 1-87 & pls. 1-107.

DUNCAN, F.M. 1937. On the dates of publication of the Society's "Proceedings", 1859-1926. With an Appendix containing the dates of publication of "Proceedings", 1830-1858, compiled by the late F.H. Waterhouse, and of the "Transactions", 1833-1868, by the late Henry Peavot, originally published in P.Z.S. 1893, 1913. *Proceedings of the Zoological Society of London, Series A* 107(1): 71-84.

FÉRUSSAC, A.E.J.P.J.F. d'A., Baron de. 1827. Catalogue des espèces de Mollusques terrestres et fluviatiles, recueillies par M. Rang, offic. de la marine roy., dans un voyage aux grandes Indes. *Bulletin des Sciences Naturelles et de Géologie, Deuxième Section du Bulletin Universel des Sciences et de l'Industrie* 10: 298-307, 408-413.

FINET, Y. 1985. Preliminary faunal list of the marine mollusks of the Galápagos Islands. *Documents de Travail de l'Institut royal des Sciences Naturelles de Belgique* n° 20, 50 pp.

FINET, Y. 1994. *The marine mollusks of the Galápagos Islands : a documented faunal list*, Muséum d'Histoire Naturelle de Genève, 180 pp.

FISCHER-PIETTE, E. 1937. Dates de publication du "Journal de Conchyliologie" de 1861 à 1900. *Journal de Conchyliologie* 81(1): 88-92.

FISCHER-PIETTE, E. 1950. Liste des types décrits dans le Journal de Conchyliologie et conservée dans la collection de ce Journal [part 1]. *Journal de Conchyliologie* 90(1): 8-23, pl. 1.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1985. *International Code of Zoological Nomenclature*, 3rd edition. Berkeley, University of California Press, xx + 338 pp.

JOHNSON, R.I. 1963. The arrangement and contents of the genera described in J.C. Chenu's "Illustrations Conchyliologiques" (1843-53). *Journal of the Society for the Bibliography of Natural History* 4(2): 92-95.

KABAT, A.R. 1990. Species of Naticidae (Mollusca : Gastropoda) described by Linnaeus in the "Systema Naturae" (1758). *Zoological Journal of the Linnean Society*, 100 (1) : 1-25.

KABAT, A.R. & Y. FINET. 1992. Catalogue of the Neritidae (Mollusca : Gastropoda) described by Constant A. Récluz, including the location of the type specimens. *Revue Suisse de Zoologie* 99(2): 223-253.

KILBURN, R.N. 1976. A revision of the Naticidae of southern Africa and Moçambique (Mollusca). *Annals of the Natal Museum* 22(3): 829-884.

KONINCK, L. de. 1838. Description des coquilles fossiles de l'argile de Basele, Boom, Schelle, etc. *Nouveaux Mémoires de l'Académie Royale des Sciences et Belles-Lettres de Bruxelles* 11: 1-37, pls. 1-4.

MAJIMA, R. 1989. Cenozoic fossil Naticidae (Mollusca : Gastropoda) in Japan. *Bulletins of American Paleontology* 96(331): 1-159, pls. 1-14.

MARINCOVICH, L., Jr. 1977. Cenozoic Naticidae (Mollusca : Gastropoda) of the northeastern Pacific. *Bulletins of American Paleontology* 70(294): 165-494, pls. 17-42.

NESBITT, E.C. & W. PITT. 1986. *Nassarius* (Gastropoda : Neogastropoda) from the Galápagos Islands. *The Veliger* 28(3): 294-301.

PETIT DE LA SAUSSAYE, S. 1856. Observations sur quelques-unes des coquilles décrites dans les quatre premiers volumes du Journal de Conchyliologie. *Journal de Conchyliologie* 5(1): 30-43.

PEYROT, A. 1938. Les mollusques testacés univalves des dépôts helvétiens du Bassin Ligurien. Catalogue critique, descriptif et illustré. *Actes de la Société Linnéenne de Bordeaux* 89(Suppl.): 5-361.

PHILIPPI, R.A. 1849-1853. *Die Gattungen* Natica *und* Amaura. *Systematisches conchylien-Cabinet von Martini und Chemnitz* 2(1): 1-164, pls. 1-19, A. [pp. 1-8, pls. 1-6, 1849; pp. 19-26, pls. 7-12, 1850; pls. A, 13-18, 1851; pp. 27-120, pl. 19, 1852; pp. 121-164, 1853]. Nürnberg, Verlag von Bauer und Raspe.

RÉCLUZ, C.A. 1843a. *G. Natica*. Volume 3, pls. 2-4 [text and pl. 1 never published], *in* : M. Chenu (ed.), *Illustrations Conchyliologiques, ou description et figures de toutes les coquilles connues vivantes et fossiles, classées suivant le système de lamarck, modifié d'après les progrès de la science, et comprenant les genres nouveaux et les espèces récemment découvertes*. Paris, Fortin, Masson et Cie.

RÉCLUZ, C.A. 1843b-1844a. *G. Sigaretus*. Sigaret, Lamarck. Volume 3, 24 pp., 4 pls., *in* : M. Chenu (ed.), *Illustrations Conchyliologiques, ...* Paris, Fortin, Masson et Cie. [pp. 1-12 and pls. 1-4 were published in 1843; pp. 13-24 in 1844].

RÉCLUZ, C.A. 1844b ["1843"; publ. June 1844]. Descriptions of new species of *Navicella*, *Neritina*, *Nerita*, and *Natica*, in the cabinet of H. Cuming, Esq. *Proceedings of the Zoological Society of London* 11(130): 197-214.

RÉCLUZ, C.A. 1850. Description de Natices nouvelles. *Journal de Conchyliologie* 1(4): 379-402, pls. 13-14.

RÉCLUZ, C.A. 1851a. Description d'une Natice nouvelle. *Journal de Conchyliologie* 2(1): 87-88.

RÉCLUZ, C.A. 1851b. Catalogue des espèces du genre Sigaret (*Sigaretus* Lk.). *Journal de Conchyliologie* 2(2): 163-191, pl. 6.

RÉCLUZ, C.A. 1851c. Description de quelques coquilles nouvelles. *Journal de Conchyliologie* 2(2): 194-216, pls. 5-6.

RÉCLUZ, C.A. 1851d. Notice sur la *Natica canrena* des auteurs. *Journal de Conchyliologie* 2(3): 251-254.

RÉCLUZ, C.A. 1852a. Description de Natices nouvelles, et notice sur quelques espèces du même genre. *Journal de Conchyliologie* 3(2): 168-173, pls. 7-8.

RÉCLUZ, C.A. 1852b. Des Natices propres aux côtes de la France continentale. *Journal de Conchyliologie* 3(3): 263-272.

RÉCLUZ, C.A. 1852c. Description de plusieurs coquilles nouvelles. *Journal de Conchyliologie* 3(4): 408-414, pl. 12.

RÉCLUZ, C.A., 1853a. Description de coquilles nouvelles. *Journal de Conchyliologie* 4(1): 49-54.

RÉCLUZ, C.A. 1853b. Description de coquilles nouvelles (G. *Pecten*, *Tellina* et *Natica*). *Journal de Conchyliologie* 4(2): 152-156, pls. 5-6.

RÉCLUZ, C.A. 1853c. Description de quelques Nérites et d'une Natice. *Journal de Conchyliologie* 4(3): 317-320, pl. 7.

RÉCLUZ, C.A. 1856. Histoire du G. Natice (*Natica* Adanson). *Journal de Conchyliologie* 5(1): 43-64.

RÉCLUZ, C.A. (no date). *Catalogue de la collection des familles des Néritides & Naticides du Cabinet de M. C. Récluz*. [manuscript].

REEVE, L.A. 1855. *Conchologia Iconica. Or, Illustrations of the shells of molluscous animals.* Volume 9, *Natica*, pls. 1-30. London, L. Reeve.

REEVE, L.A. 1864. *Conchologia Iconica. Or, Illustrations of the shells of molluscous animals.* Volume 15, *Sigaretus*, pls. 1-5. London, L. Reeve & Co.

SHERBORN, C.D. and E.A. SMITH. 1911. A collation of J.C. Chenu's "Illustrations Conchyliologiques", and a note on P.L. Duclos' "Hist. Nat. Gén. et Part. Coquilles". *Proceedings of the Malacological Society of London* 9(4): 264-267.

SOULEYET, L. 1852. *In : Voyage autour du monde exécuté pendant les années 1836 et 1837 sur la corvette La Bonite commandée par M. Vaillant, Capitaine de Vaisseau... Zoologie par MM. Eydoux et Souleyet.* Paris, Arthus Bertrand. Vol. 2 : 664 pp., pls.

SOWERBY, G.B., II. 1882. *Monograph of the genus* Sigaretus, *Lamarck, including* Naticina, *Gray. Thesaurus Conchyliorum, or figures and descriptions of Recent shells*, 37/38 : 39-47, pls. 1-3 [pls. 441-442]. London, Sowerby.

SOWERBY, G.B., II. 1883. *Monograph of the genus* Natica. *Thesaurus Conchyliorum, or figures and descriptions of Recent shells*, 39/40 : 75-104, pls. 1-9 [pls. 454-462]. London, Sowerby.

TRYON, G.W., Jr. 1886. *Manual of Conchology* (Ser. 1). Philadelphia, Academy of Natural Sciences, Vol. 8 : 461 pp., 79 pls.

VERBERCKT, J. 1995. On the correct name of "*Natica fanel* Adanson" of authors and a new name for *Natica multipunctata* Wood, 1842. *Gloria Maris* 33(6): 113.

WEINKAUFF, H.C. 1883. *Die Gattung* Sigaretus. *Systematisches Conchylien-Cabinet von Martini und Chemnitz*, 6 (1) : 1-50, pls. A, 1-10. Nürnberg, Verlag von Bauer und Raspe.

WINCKWORTH, R. 1936. Journal de Conchyliologie : dates of publication. *Proceedings of the Malacological Society of London* 22(3): 153-156.

On a collection of Columbellidae from the Red Sea

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KEYWORDS. Columbellidae, Red Sea, new species.

ABSTRACT. The authors have studied the Columbellidae from the Red Sea, preserved in the Muséum National d'Histoire Naturelle in Paris, especially the collection donated by Félix Jousseaume. Seventeen species are reported, among them a new one, *Pyrene jousseaumei* n. sp.

RESUME. Les auteurs ont étudié les Columbellidae de la Mer Rouge du Muséum National d'Histoire Naturelle , Paris, spécialement de la collection léguée par Félix Jouseaume. 17 espèces y ont été répertoriées, et parmi elles une espèce nouvelle, *Pyrene jousseaumei*, n. sp.

I. INRODUCTION

One of the most remarkable and colourful characters in the malacological exploration of the Red Sea and the Gulf of Aden must have been Felix Jousseaume. Born in 1835, and french medical doctor, Jousseaume published from 1869 numerous notes and pamphlets on conchology, including major papers on Marginellidae, Cancellariidae and Triphoridae. After he had retired, he started visiting the Red Sea and the Gulf of Aden, and spent there nine winters between 1889 and 1900 (LAMY 1921). Jousseaume was a gifted collector and brought together a comprehensive collection of molluscs, which to this date remains the largest known for this part of the world. In 1893, Jousseaume became a *correspondant* of the Muséum National d'Histoire Naturelle in Paris, to whom he donated his superb collection and library at his death, in 1921.

Much of the Columbellidae collected by Jousseaume had remained unidentified and unreported so far; we are pleased to name a new species of *Pyrene* after him.

Except when otherwise stated, records localities are those quoted by Jousseaume in each of his samples. Average lengths have been established after measuring 10 adult specimens of the species.

II. SYSTEMATICS

Pyrene aspersa (Sowerby, 1844). Fig. 1.

Description.

Thick, biconical, whorls convex and smooth. Colour pattern made of creamy-white ocelli, often confluent, on a brown ground.

Average length : 21.2 mm.

Records : Aden, Red Sea.

Pyrene flava (Bruguière, 1789).

Description.

Very variable colour pattern of reddish-brown wavy lines and irregular blotches on a creamy background. Protoconch of 1.5 to 2 smooth whorls.

Average length : 17.7 mm.

Records : Aden, Djibouti, Obock, Perim I., Hodeidah, Abulat I. (Abu Latt I., Sawdi Arabia) , Kad ed el Hamden (Sawdi Arabia), Suez.

Pyrene jousseaumei n. sp. Figs. 2-3.

Description.

Biconical and rounded in shape. Teleoconch of 6 strongly convex whorls. Whorls sculptured with spiral furrows, numbering 9 on penultimate whorl, becoming less obvious on body-whorl. Aperture narrow. Outer lip thick bearing 9 denticles. Columella smooth. Base with 10 closely-set spiral furrows. Protoconch missing in type, and consisting of one smooth whorl in a juvenile paratype.

Colour fawny-brown, with small rounded creamy-white blotches, disposed in irregular spiral rows (2 on body-whorl) and axial lines (about 4 per whorl).

Dimensions: holotype height 15.7 x width 7.6 mm. Max. size of examined material: 17.3 x 9.2 mm.

Remarks.

This species differs from *P. pelotina* (Duclos, 1840) in its larger size, in its different colour pattern, in its

spiral furrows on whorls (*P. pelotina* is smooth on whorls), in its more convex whorls, and in its 10 spiral furrows on base instead of 5 in *P. pelotina*.

This new species differs from *P. propinqua* (E.A. SMITH 1891), that seems to be the nearest species, in its colour pattern (*P. propinqua* is white with dark-brown blotches), in its 10 spiral furrows on base instead of 8 in *P. propinqua*, and in the lack of the axial furrows that *P. propinqua* bears on the whole shell.

Type material.

Holotype and 29 paratypes in Muséum National D'Histoire Naturelle, Paris. 2 paratypes in the collection of J. Drivas.

Type Locality.

Perim I. (Yemen).

Distribution.

This species seems to be endemic to the Red Sea and the Gulf of Aden (Aden, Obock, Djibouti).

Etymology.

Named in honour of Félix Jousseaume.

Pyrene propinqua (E.A. Smith, 1891). Fig. 4.

Description.

Biconical. Whorls sculptured with fine axial ribs, intersected by spiral cords. Colour dark-brown with large widely-spaced creamy-white ocelli.

Average length : 12.4 mm.

Records : Abulat (Abu Latt) I.

Euplica festiva (Deshayes in Laborde & Linant, 1834).

Euplica azora (Duclos, 1840) (new synonym).

Euplica albinodulosa (Gaskoin, 1851) (new synonym)

Description.

Axial ribs more or less marked, and spiral striae stronger on base than elsewhere on body-whorl. Ground colour greyish, with white blotches on crests of axial ribs; and one single or double spiral row of brown blotches on spire whorls, and 3 rows on body-whorl. Protoconch of 1.5 to 2 smooth whorls.

Average length : 9.9 mm.

Records : Aden, Obock, Djibouti, Perim I., Massawa, Massaouah, (Massaoua), Ras Zeiti (Ras Saati, Erythrea), Abulat (Abu Latt) I., Djeddah, Tor (El Tor, Sinaï), Sherm Sheikh (Sinaï) Suez.

Remarks.

We previously thought that *E. azora* differed from *E. albinodulosa* only in 2 spiral rows of brown spots instead of one. Examination of more material showed many intermediates between those two patterns.

Mitrella albina (Kiener, 1841).

Description.

A subsutural row of large nodules developing on last half of body-whorl. Colour greyish-white, with white nodules and obsolete irregular brown blotches. Base of rostrum with a fairly characteristic brown blotch. Protoconch of 2.5 smooth whorls.

Average length : 14.3 mm.

Records : Aden, Obock, Djibouti, Perim I., Sherm Sheikh.

Mitrella conspersa (Gaskoin, 1851).

Description.

Colour variable, but the white and brown subsutural band, continuous on body-whorl is present in all specimens examined. Aperture purple-tinted in adult specimens. Protoconch of 2.5 smooth whorls.

Average length :11.2 mm.

Records : Al Sayad (?), Abulat (Abu Latt) I., Akaba, Suez, Red Sea.

Mitrella margarita (Reeve, 1859).

Description.

One subsutural spiral row of quadrangular white blotches.

Average length : 9 mm.

Records : Aden, Perim I.

Mitrella nomadica (Melvill & Standen, 1901). Fig.5.

Description.

Fusiform in shape. Spire twice as high as aperture. Colour red-brown with creamy-white ocelli; one spiral row of larger ocelli in the middle of body-whorl.

Average length : 15 mm.

Records : Aden, Suez, Akaba.

Mitrella nympha (Kiener, 1841).

Description.

Colour pattern variable, with golden to greyish axial lines on white background. Outer lip occasionally brown-tinted.

Average length : 9.8 mm.

Records : Aden, Djibouti, Obock, Perim I., Massaoua, Souakim (Souakin, Soudan), Hodeidah, Djeddah, Suez, Akaba.

Zafra exilis (Philippi, 1847). Fig. 6.

Description.

Fusiform. Whorls sculptured with axial ribs, more obvious on spire than on body-whorl. Colour brown, more or less dark, with 2 spiral rows of creamy-white blotches, one of them at the upper part of whorls, the lower one near suture on spire, and at the middle of body-whorl. The species is endemic to the Red Sea.

Average length : 4.3 mm.

Records : Aden, Djibouti, Obock, Perim, Massaouah (Massaoua), Souakim (Souakin), Hodeidah, Djeddah, Akaba, Red Sea.

Zafra minuscula (Gould, 1860).

Description.

Uniform dark-brown. Protoconch of 3 smooth whorls.

Average length : 3.6 mm.

Records : Aden, Djibouti, Obock, Perim I., Massaouah, Massawa (Massaoua). Souakim (Souakin), Djeddah, Hodeidah.

Zafra savignyi Moazzo, 1939. Fig. 7.

Description.

Shell much wider than *Z. exilis* , and with axial ribs that are slightly oblique and more neatly marked. Pale-brown with creamy-white blotches on ribs, on the entire heigth of whorls.

Average length : 3.7 mm.

Records : Suez.

Zafra succinea (Hervier, 1899).

Description.

14 axial ribs on body-whorl. 10 basal lirae. One shallow subsutural groove. Pale-brown in colour, upper part of each whorl white. The brown area on body-whorl often delimited posteriorly by a darker line. Protoconch of 3 smooth whorls.

Average length : 3.6 mm.

Records : Obock, Djeddah.

Zafra troglodytes (Souverbie, 1866).

Description.

More biconical in shape than *Z. succinea*, with a carinated protoconch, and a different colour pattern.

Average length : 3.3 mm.

Records : Aden, Djibouti, Obock, Perim I., Massawa (Massaoua), Souakim (Souakin), Abulat (Abu Latt) I., Djeddah, Akaba.

Anachis fauroti (Jousseaume, 1888). Fig. 8.

Description.

Biconical. Widely-spaced axial ribs, numbering 14 on last whorl. Creamy-white with a wide pale-brown spiral band, and dark-brown blotches on ribs.

Average length : 15.5 mm.

Records : Aden, Djibouti, Obock, Perim, Suez, Red Sea.

Zafrona isomella (Duclos, 1840).

Description.

Axial ribs crossed by spiral cords. Outer lip and columella denticulate.

Average length : 4.1 mm.

Records : Djibouti.

REFERENCES

DUCLOS, P.L. 1840. *Coquilles univalves marines à l'état vivant et fossile, publiée par monographies. Genre* Colombella. Paris, Didot ed.

LAMY, E. 1921. Nécrologie. Dr. F. Jousseaume. *J. Conchyl.* 66: 79-85.

SMITH, E.A. 1891. On a collection of Marine shells from Aden, with some remarks upon the relationship of the molluscan fauna of the Red Sea and the Mediterranean. *Proc. Zool. Soc. London*: 390- 436.

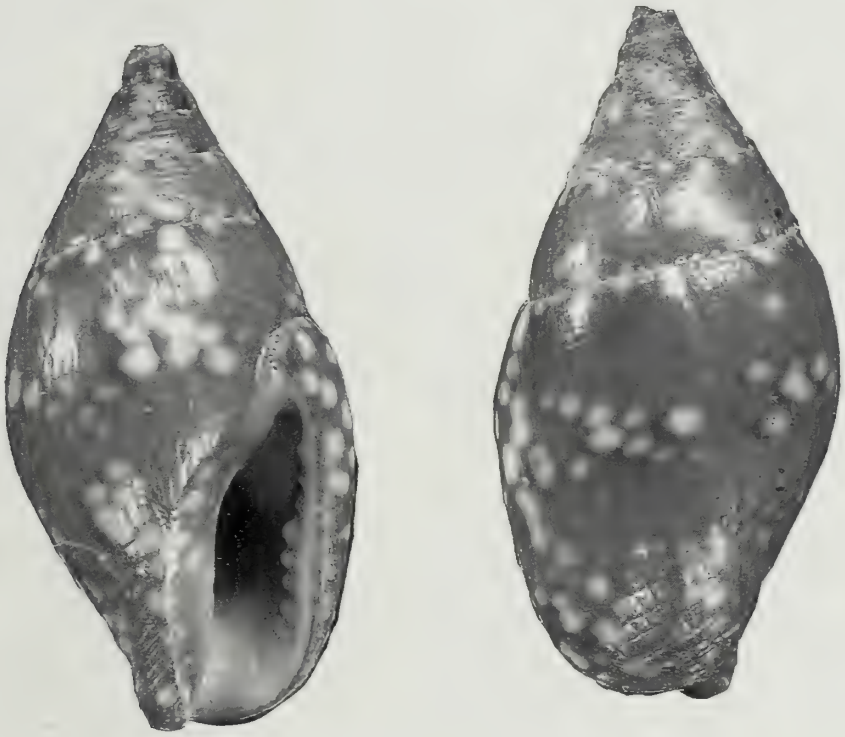
Fig. 1: *Pyrene aspersa* (Sowerby, 1844) : 21 mm. **Figs. 2-3**: *Pyrene jousseaumei*, n.sp. Holotype : 15,7 mm, MNHN, Paris. **Fig. 4**: *Pyrene propinqua* (E.A. Smith, 1891) : 12.4 mm. **Fig. 5**: *Mitrella nomadica* (Melvill & Standen, 1901) : 15 mm. **Fig. 6**: *Zafra exilis* (Philippi, 1847) : 4.3 mm. **Fig. 7**: *Zafra savignyi* Moazzo, 1939 : 3.7 mm. **Fig. 8**: *Anachis fauroti* (Jousseaume, 1888) : 15.5 mm.

ERRATUM

DRIVAS, J. & M. JAY. 1997. On a collection of Collumbellidae from the Red Sea. *Apex* 12(1): 27-30.

An unfortunate mistake, for which the authors apologise, has taken place in the picture illustrating the holotype of *Pyrene jousseaumei* n. sp. (DRIVAS & JAY, 1997: figs 2-3). As the readers may have realised, the erroneous picture illustrates a specimen of *Zafrona isomella* (Duclos, 1840). The real holotype (MNHN) of *Pyrene jousseaumei* Drivas & Jay, 1997 is here figured.

J. Drivas & M. Jay



Pyrene jousseaumei Drivas & Jay, 1997
Holotype MNHN, 15.7 mm X 7.6 mm

Editor's note: we recommend to place this page between pp. 30 and 31 of *Apex* 12(1).

Report on a collection of Columbellidae (Mollusca, Gastropoda) from the west Indian Ocean region (Madagascar, Glorieuses Islands, Comores Islands, and nearby banks and coral shawls) with descriptions of three new species and one new genus

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KEYWORDS. Columbellidae, West Indian Ocean, report, new species.

ABSTRACT. The authors have studied the Columbellidae of the West Indian Ocean region, through two sources: the BENTHEDI oceanographic expedition, and the THOMASSIN-PEYROT CLAUSADE collection, both preserved in the Muséum National d'Histoire Naturelle in Paris. 37 species were recorded. Three new species are described and range extensions are reported for 30 species.

RESUME. Les auteurs ont étudié les Columbellidae de l'Océan Indien occidental, dans un matériel déposé au Museum National d'Histoire Naturelle de Paris, provenant de deux sources: l'expédition océanographique BENTHEDI, d'une part, et la collection THOMASSIN-PEYROT CLAUSADE, d'autre part. 37 espèces sont répertoriées, avec pour 30 d'entre elles, une extension de la zone d'habitat. Trois nouvelles espèces sont décrites.

I. INTRODUCTION

To our knowledge, no study on the Columbellidae of the west Indian Ocean region nor Mozambique Channel, was ever made, except for two lists of species from Seychelles, one by VON MARTENS in 1880 (listing 6 species: *Columbella flavida*, *C. flavida* var. *undata*, *C. turturina*, *C. lactea*, *C. nympha*, *C. seychellarum*), and one by DAUTZENBERG in 1893 (listing 3 species: *Columbella azora* var. *albinodulosa*; *C. turturina*; *C. troglodytes*.); and two reports of species from Madagascar, one by VON MARTENS (one species, *Columbella fulgurans*) and one by DAUTZENBERG in 1932 (listing 7 species: *Columbella azora*; *C. galaxias*; *C. moleculina*; *C. flava*; *C. tankervillei*; *C. moleculinella*; *C. troglodytes*). Some of the reported species fall actually into synonymy, namely *Columbella azora* and *C. albinodulosa* (syn. *Euplica festiva*); *Columbella flavida* (syn. *Pyrene flava*); *Columbella lactea* (syn. *Mitrella moleculina*); *Columbella galaxias* (syn. *Mitrella nympha*); *Columbella moleculinella* (syn. *Pyreneola. shepstonensis*). The above lists concern thus only 10 species, most of them having a widely Indo-Pacific distribution. *Mitrella seychellarum* (Von Martens, 1904) is known only from Seychelles.

In the present paper, we record the Columbellidae collected in the 1970s by two sources:

(1) The BENTHEDI oceanographic Expedition was conducted on board R.V. "Le Suroit" under the direction of Dr. Bernard Thomassin. From 17 March to 14 April 1977, with a total of 125 stations (dredge hauls and trawlings down to 3700 m; SCUBA dives), the expedition surveyed the benthic marine fauna of the northeastern part of the Mozambique Channel: Glorieuses Is., Geyser, Zelée and Leven Banks (between Madagascar and the Comores) and Mayotte (Comorro archipelago). Philippe Bouchet was the malacologist of the expedition; unsorted bottom samples were later sorted in MNHN by Ms. Annie Tillier. Columbellids were present, as live-taken or empty shells, down to 550 m, and a total of 24 species is present in this collection. Previous papers based on this expedition have dealt with Buccinacea and Mitracea (CERNOHORSKY 1982) Terebridae (BRATCHER & CERNOHORSKY 1982), Architectonicidae (BIELER 1987) and Polyplacophora (LELOUP 1981, KAAS 1985).

(2) From 1972 to 1977, Drs Bernard Thomassin and Mireille Peyrot-Clausade (both from Station marine d'Endoume, Marseille, France) conducted an

ecological survey of the Tulear reef system (S.W. Madagascar). Numerous quantitative or semi-quantitative samples were collected in various microhabitats, with emphasis on sediments (THOMASSIN 1978) and small cavities in hard substrat (PEYROT-CLAUSADE 1977). This collection contains 595 lots of Columbellidae, for a total of 29 species.

Most species are represented from both sources. The total material consists of 809 lots of Columbellidae, containing only 37 species. Of the 10 species previously quoted by Dautzenberg and Von Martens from Madagascar, 7 have been found again in this material, namely *Pyrene flava*; *Euplica albinodulosa* a synonym of *Euplica festiva* (Deshayes in Laborde & Linant, 1834) (DRIVAS & JAY 1990); *Euplica turturina*; *Mitrella galaxias* (Reeve, 1859) a synonym of *M. nympha* (Kiener, 1841)(DRIVAS & JAY 1990); *Mitrella lactea* (Duclos, 1840) a synonym of *M. moleculina* (Duclos, 1840); *Pyreneola moleculinella* (Dautzenberg, 1932) a synonym of *P. shepstonensis* (E.A. Smith, 1910) (DRIVAS & JAY 1990); and *Zafra troglodytes*. But 2 of the previously quoted species are not represented in the Benthedi-Thomassin material, namely *Pyrene tankervillei*, and *Pyrene fulgurans*. Three new species are described, and range extensions are reported for 30 species. In the lists of material examined, the abbreviation "spm" refers to live-taken as well as empty shells. Unless otherwise stated, the material is now housed in the Muséum National d'Histoire Naturelle, Paris.

II. SYSTEMATICS

Family **COLUMBELLIDAE**

Genus ***Pyrene*** Röding, 1798.

General shape biconical; early whorls with a strong spiral subsutural cord, which disappears on later whorls; interior of outer lip crenulated.

Pyrene flava (Bruguière, 1789). Fig. 1.

Tulear, without mention of depth. BENTHEDI st. 5, Banc du Leven, 12°32' S, 47°40'2 E, 35-150m, (1 spm). st. 16, Mayotte 12°45'2 S, 45°15'7 E, 3-8m, (1spm). st.110, Banc de la Zélée 12°25'6 S, 46°16'2 E, 24m (1 spm).

Genus ***Euplica*** Dall, I889.

The genus is characterized by its two columellar folds, and a protoconch which bears fine axial riblets.

Euplica festiva (Deshayes in Laborde & Linant, 1834). Fig 2.

Synonym : *Euplica albinodulosa* (Gaskoin,1851).

Records : Tulear, without mention of depth.

Euplica ionida (Duclos, 1840). Fig. 3.

The extreme variability of colour pattern explains the fairly abundant synonymy:

Colombella ionida Duclos, 1840. (Type locality Reunion Island, by subsequent designation, DRIVAS & JAY, 1990)
Columbella scalpta Reeve, 1859. (Type locality unknown).
Columbella amirantium Smith, 1884. (Type locality: Eagle Isl. Amirantes).
Columbella amirantium var. *ovata* Hervier, 1899. (Type locality: Lifu,New Caledonia).
Columbella scalpta var. *decora* Hervier, 1899. (Type locality: Lifu, New Caledonia).
Columbella liocyma Pilsbry, 1904. (Type locality: Japan).

Records : Tulear, I7 lots without mention of depth; Nosy-Be, 1 lot without mention of depth; BENTHEDI st. 5, Banc du Leven, 12°32' S, 47°40'2 E, 35-150m, (12 spms); st. 8, Glorieuses, 11°29'2 S, 47°18'2 E, 250m, (1 spm); st. 14 , Banc du Geyser 12°22 S, 46°23'7 E, 5-20m, (19 spms); st. 16, Mayotte 12°45'2 S, 45°15'7 E, 3-8m, (1 spm); st. 24, Mayotte 12°37' S, 45°9'9 E, 16-18m, (3 spms); st. 32, Mayotte, 12°45'1 S, 45°17'9 E, 15-20m, (2 spms); st. 50, Mayotte, 12°54'5 S, 44°58'5 E, 32m, (1 spm); st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-5m, (1 spm); st. 79, Mayotte, 12°33'5 S, 44°56'4 E, 25m, (5 spms); st. 93, Glorieuses , 11°32'3 S, 47° 16'4 E, 480-550m, (5 spms); st. 101, Glorieuses 11°25'7 S, 47°19'5 E, 26m, (4 spms); st. 106, Banc de la Zélée, 12°25'5 S, 46°16'1 E 18-24m, (2 spms); st. 110, Banc de la Zélée 12°25'6 S, 46°16'2 E, 24m, (10 spms); st. 117, Banc du Geyser 3-8m, (2spms); st. 124, Glorieuses, 11°32'1 S, 47°23'1 E, 24m, (41 spms); st. 125, Glorieuses, 11°30'6 S, 47°22'8 E, 7m, (2 spms).

Euplica turturina (Lamarck, 1822). Fig. 4.

Tulear: 5 lots without mention of depth. Tulear: 1 lot, internal slope, in cavities; Mayotte: 1 lot, Agalega islet, 12 m.; BENTHEDI st. 16, Mayotte, 12°45'2 S, 45°15'7 E, 3-8m, (1spm); st. 56, Mayotte, 12° 53'5 S, 44°57'1 E, 3-5m, (2 spms); st. 79, Mayotte, 12°33'5 S, 44°56'4 E, 25m, (1 spm); st. 101, Glorieuses, 11°25'7 S, 47°19'5 E, 26m, (1spm); st. 125, Glorieuses, 11°30'6 S, 47°22'8 E, 7m, (2 spms).

Euplica varians (Sowerby, 1832). Fig. 5.

Tulear: 2 lots on the reef, in cavities; Tulear:1 lot, internal slope; 29 lots, without mention of depth; Nosy-Bé: 1 lot without mention of depth; Nosy-Bé: 1 lot on the reef, 5 m; BENTHEDI, st. 32, Mayotte, 12°45'1 S, 45°17'9 E, 15-20 m, (1spm); st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-5m, (1 spm).

Genus *Mitrella* Risso, 1826.

Protoconch smooth. Spire turreted, high compared to aperture; surface smooth or spirally sculptured; outer lip of aperture denticulate.

Mitrella albina (Kiener, 1841). Fig 6.

Tulear: 7 lots without mention of depth; Nosy-Bé 2 lots without mention of depth; BENTHEDI st. 14, Banc du Geyser, 12°22 S, 46°23'7 E, 5-20m, (1 spm); st. 18, Mayotte, 12°45' S, 45°15'9 E, 15m, (1 spm); st. 23, Mayotte, 12°46'2 S, 45°15,5 E, 6m, (2 spms); st. 24, Mayotte 12°37' S, 45°9'9 E, 16-18m, (2 spms); st. 32, Mayotte, 12°45'1 S, 45°17'9 E, 15-20m, (10 spms); st. 50, Mayotte, 12°54'5 S, 44°58'5 E, 32m, (1 spm); st. 51, Mayotte, 12°54'5 S, 44°58'2 E, 15m, (8 spms); st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-5m, (1 spm); st. 79, Mayotte, 12°33'5 S, 44°56'4 E, 25m, (8 spms); st. 93, Glorieuses, 11°32'3 S, 47°16'4 E, 480-550m, (1 spm); st. 100, Glorieuses, 11°32'4 S, 47°16'8 E, (1 spm); st. 101, Glorieuses, 11°25'7 S, 47°19'5 E, 26m, (4 spms); st. 110, Banc de la Zélée, 12°25'6 S, 46°16'2 E, 24m, (8 spms); st. 116, Banc du Geyser, 13m, (3 spms); st. 124, Glorieuses, 11°32'1 S, 47°23'1 E, 24m, (10 spms); st. 125, Glorieuses, 11°30'6 S, 47°22'8 E, 7m, (1 spm).

Mitrella albuginosa (Reeve, 1859). Fig. 7.

Tulear. BENTHEDI st. 5, Banc du Leven, 12°32 S, 47°40'2 E, 35-150m, 1 spm.

Mitrella conspersa (Gaskoin, 1851). Fig. 8.

Tulear. BENTHEDI st. 49, Mayotte, 12°54'6 S, 44°56'8 E, 300-450m, (1 spm).

Mitrella floccata (Reeve, 1859). Fig. 9.

BENTHEDI st. 5, Banc du Leven, 12°32' S, 47°40'2 E, 35-150m, (1spm)

Mitrella goubini (Hervier, 1899). Fig. 10.

Protoconch of 1.5 smooth whorls;

Records : Tulear: 3 lots without mention of depth; Nosy-Bé 1 lot on the reef, 5 m; BENTHEDI st. 14, Banc du Geyser, 12°22 S, 46°23'7 E, 5-20m, (1 spm); st. 16, Mayotte, 3-8m, 12°45'2 S, 45°15'7 E, 3-8m, (1 spm); st. 21, Mayotte, 12°46'5 S, 45°15'5 E, 3-8m, (2 spms); st. 32, Mayotte, 12°45'1 S, 45°17'9 E, 15-20m. (1 spm); st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-5m, (1 spm).

Mitrella innocens (Thiele, 1925). Fig. 11.

BENTHEDI st. 6, W des Glorieuses, 11°28'5 S, 47°12'2 E, 298-301m, (1 spm), 300-460m, (2 spms); st. 10, W des Glorieuses, 11°28'5 S, 47°17'7 E, 294-440m, (24 spms); st. 33, Mayotte, E passe Longosi, 12°53'5 S, 45°16'3 E, 275-400m, (4 spms); st. 71, Mayotte, NE récif N, 12°29'9 S, 45°02'E, 450m, (2 spms); st. 93, SW Grande Glorieuse, 11°32'3 S, 47°16'4 E, 480-550m, (32 spms); st. 94, SW Grande Glorieuse, 11°32'2 S, 47°16'4 E, 450m, (150 spms); st. 104, Glorieuses, N Ile du Lys, 11°26'4 S, 47°22'3 E, 330-530m, (2 spms); st. 120, SE Glorieuses, 11°30 S, 47°24'7 E, 335-395m, (53 spms); st. 122, Glorieuses SE Grande Glorieuse, 11°32' S, 47°23'2 E, 615-625m, (26 spms).

Mitrella margarita (Reeve, 1859). Fig. 12.

Tulear: 10 lots without mention of depth; Nosy-Bé: 1 lot without mention of depth.

Mitrella moleculina (Duclos, 1840). Fig. 13.

The interrupted subsutural dark-brown line is a distinctive character, but uncommonly lacking, especially in albino specimens. Its pattern may be very similar to *M. goubini*, but it is easily distinguished from it in its protoconch of 3.5 smooth whorls instead of 1.5.

Records : Tulear: 16 lots without mention of depth; Nosy-Bé: 1 lot without mention of depth; BENTHEDI st. 5, Banc du Leven, 12°32' S, 47°40'2 E, 35-150m, (2 spms); st. 6, Glorieuses, 11°28'5 S, 47°12'2 E, 460-500m, (1 spm); st. 14 , Banc du Geyser, 12°22 S, 46°23'7 E, 5-20m, (15 spms); st. 32, Mayotte, 12°45'1 S, 45°17'9 E, 15-20m, (1 spm); st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-5m, (7 spms); st. 78, Mayotte, 12°33'7 S, 44°55'6 E, 80-140m, (1 spm); st. 79 Mayotte, 12°33'5 S, 44°56'4 E, 25m. (2 spms); st. 93, Glorieuses, 11°32'3 S, 47°16'4 E, 480-550m, (5 spms); st. 94, Glorieuses, 11°32'2 S, 47°16'4 E, 450m, (1 spm); st. 106, Banc de la Zélée, 12°25'5 S, 46°16'3 E, 18-24m, (1 spm); st. 109, Banc de la Zélée, 12°25'6 S, 46°15'2 E, 50m. (1 spm); st. 110, Banc de la Zélée, 12°25'6 S, 46°16'2 E, 24m, (2 spms).

Mitrella nympha (Kiener, 1841). Fig. 14.

Tulear: 1 lot without mention of depth.

Mitrella rorida (Reeve, 1859). Fig. 15.

Tulear: 2 lots without mention of depth; Mayotte: 1 lot, Agalega islet, 12 m.

Mitrella seychellarum (Von Martens, 1904). Fig. 16.

Tulear; BENTHEDI st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-5m, (7 spms); st. 79 Mayotte, 12°33'5 S, 44°56'4 E, 25m, (2 spms).

Mitrella venulata (Sowerby, 1894). Fig. 17.

Tulear: 1 lot without mention of depth.

Genus *Pyreneola* Iredale,1918.

Shell small in size, ovate elongate, with a rather elevated spire; surface smooth; anterior canal short and narrow; columellar callus expended posteriorly, its edge somewhat raised.

Pyreneola cincinnata (Von Martens, 1880). Fig. 18.

Tulear: 9 lots without mention of depth.

Pyreneola lozoueti n.sp. Figs. 20-21.

Description.

Spire a little higher than aperture. Protoconch of about 1.5 smooth whorls. Teleoconch of 6 whorls. Surface smooth except for 5 spiral ridges on base of body-whorl. Columella with 3 denticles that are the continuation of the spiral ridges. Outer lip with 6 distinct denticles. Colour slightly greyish-white with, on some specimens, a spiral row of small lacteous white blotches, situated just above suture on whorls, and at the middle of body-whorl; and a second spiral row of larger blotches on lower part of body-whorl. On all specimens, on base, intervals between spiral ridges tinted with pale violet.

Dimensions.

Holotype heigth 4.4 mm, breadth 1.5 mm. Adult size varies: heigth from 3.4 mm to 5.5 mm and breadth from 1.2 mm to 1.9 mm.

Remarks.

Pyreneola lozoueti n.sp. differs from *Pyreneola cincinnata* (Von Martens, 1880), described from Mauritius, in its protoconch (1.5 whorls instead of 2.5) and in its colour pattern with lack of the thin wavy axial brown lines interrupted by oval white blotches; it differs from *Pyreneola shepstonensis* (E.A. Smith, 1910), described from South-Africa, in its more slender shape, and colour pattern, consisting in *P. shepstonensis* in a spiral brown line with a row of brown blotches on each side, on a creamy-white background; and it differs from *Pyreneola melvilli* (Hedley, 1899) described from Australia, which has same size and shape, in its colour pattern, in the lack of the second spiral row of white blotches on body-whorl, in the presence of fine axial brown lines between the white blotches, on the whole shell; and in the lack of violet bands on base.

Type material.

Holotype and paratypes 1-28 in the Muséum National d'Histoire Naturelle, Paris; paratype 29 in the collection of J. Drivas.

Type locality.

Banc du Leven, BENTHEDI st. 5, 12°32' S, 47°40'2 E, 35-150m, (holotype and paratypes 1-5).

Other material.

Banc de la Zélée BENTHEDI st. 110 S, 12°25'6 S, 46°16'2 E, 24m; (paratypes 6 and 7); Banc du Geyser st. 14 , W, 12°22 S, 46°23'7 E, 5-20m. (paratypes 8 to 14); Glorieuses, st. 8, W Glorieuse, 11°29'2 S, 47°18'2 E, 250m, (paratype15); Glorieuses st. 93, SW Grande Glorieuse, 11°32'3 S, 47°16'4 E, 480-550m, (paratype 16.); Glorieuses st. 122, SE Grande Glorieuse, 11°32' S, 47°23'2 E, 615-625m, (paratypes 17-18); Glorieuses st. 124, SE Glorieuse, 11°32'1 S, 47°23'1 E, 24m, (paratypes 19-28); Paratype 29 collected in Mahe island, Seychelles, by the senior author, at the depth of 15 m, in the collection of J. Drivas.

Etymology.

Named for Mr. Pierre Lozouet, Muséum National d'Histoire Naturelle, Paris.

Pyreneola melvilli (Hedley, 1835). Fig. 19.

BENTHEDI st. 14 , Banc du Geyser 12°22 S, 46°23'7 E, 5-20m, (1 spm).

Pyreneola shepstonensis (Smith, 1910). Fig. 22.

Tulear: 3 lots, without mention of depth.

Genus *Indomitrella* Oostingh,1944.

Shell with axial sculpture, and smooth interspaces. Protoconch smooth.

Indomitrella puella (Sowerby, 1844). Fig. 23.

Tulear: 1 lot, without mention of depth.

Genus *Pleurifera* gen. n.

Type species: *Mitrella suzannae* (Drivas & Jay, 1990)

Diagnosis.

Protoconch with axial riblets; teleoconch bearing a fine axial sculpture at least on earlier whorls, and a fine spiral sculpture more visible on later whorls.

Remarks: Axially sculptured protoconch is found only in the genus *Euplica*. *Pleurifera* differs from *Euplica*

in the general shape of the high spired shell, and in the axial and spiral sculpture of teleoconch whorls.

Pleurifera suzannae (Drivas & Jay, 1990). Fig. 24.

BENTHEDI st. 6, Glorieuses 11°28'5 S, 47°12'2 E, 460-500m, (1 spm).

Genus *Metanachis* Thiele, 1924.

Early whorls with axial sculpture, disappearing on subsequent whorls; upper part of columella bearing a single denticle.

Metanachis marquesa (Gaskoin, 1851). Fig. 25.

Tulear: 11 lots without mention of depth; Nosy-Bé: 1 lot without mention of depth; BENTHEDI st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-8m, (1 spm).

Genus *Zafra* A. Adams, 1860.

Shell small, with axial ribs, and no spiral sculpture except for basal cords.

Zafra geyserensis n.sp. Figs. 26-27.

Description.

Spire heigth almost equal to aperture. Protoconch of about 1.5 smooth whorls. Teleoconch of 4 convex whorls, convexity more marked at upper part of whorls, forming a shoulder. Axial sculpture consisting of axial ribs numbering 16 on last whorl. No spiral sculpture except for 7 spiral ridges on base of body-whorl. Columella smooth. Three denticles inside outer lip. Upper part of whorls lacteous-white, lower part yellowish-grey; a single darker spiral band on lowest part of body-whorl; base white.

Dimensions.

Holotype heigth 2 mm, breadth 0.6 mm. Paratypes 1 and 2: heigth 1.8 mm, breadth 0.6 mm

Remarks.

The shape of this shell recalls that of *Seminella peasei* (Von Martens & Langkavel, 1871) *nom. subst.* for *varia* Pease, 1860, *non* Sowerby, 1832, described from Hawaii; but it differs from it in the lack of spiral sculpture in the intervals of axial ribs. It differs from *Zafra troglodytes* (Souverbie, 1866) described from New Caledonia, in its smaller size, in its more angular whorls, in its protoconch, carinated on *Z. troglodytes* but rounded in *Z. geyserensis*.

Type material.

Holotype and paratype 1 in the Muséum National d'Histoire Naturelle, Paris. Paratype 2 in the collection of J. Drivas.

Type locality.

Banc du Geyser BENTHEDI st. 14 , 12°22 S, 46°23' 7E, 5-20m. (Holotype and paratype 1)

Other material.

Paratype 2 from Mahe Island, Seychelles, 15 m deep, collected by J. Drivas.

Etymology.

Named after the "Banc du Geyser" the type locality.

Zafra morini (Viader, 1938). Fig. 28.

Tulear: 3 lots without mention of depth; Mayotte: 3 lots; Dzaoudzi, 1 lot, 8-25 m; Mayotte: 1 lot, Agalega islet, 12 m; BENTHEDI: st. 16, Mayotte, 12°45'2 S, 45°15'7 E, 3-8m, (3 spms); st. 21, Mayotte, 12°46'5 S, 45°15'5 E, 3-8m, (9 spms); st. 24, Mayotte 12°37' S, 45°9'9 E, 16-18m, (7 spms).

Zafra obesula (Hervier, 1899). Fig. 29.

Tulear: 1 lot without mention of depth; BENTHEDI st. 21, Mayotte, 12°46'5 S, 45°15'5 E, 3-8m, (2 spms).

Zafra ocellatula (Hervier, 1899). Fig. 30.

Tulear: 11 lots without mention of depth; Nosy-Bé: 1 lot without mention of depth; BENTHEDI st. 14, Banc du Geyser, 12°22 S, 46°23'7 E, 5-20m, (3 spms); st. 32, Mayotte, 12°45'1 S, 45°17'9 E, 15-20m, (1 spm); st. 117, Banc du Geyser, 12°22 S, 46°23'7 E, 3-8m, (1 spm).

Zafra minuscula (Gould, 1860). Fig. 31.

Synonym: *Zafra regulus* (Souverbie, 1864).

Records: Tulear: 4 lots without mention of depth.

Zafra succinea (Hervier, 1899). Fig. 32.

Tulear: 17 lots without mention of depth; Nosy-Bé 1 lot without mention of depth; Mayotte: 1 lot, Dzaoudzi 8 m; BENTHEDI st. 21, Mayotte, 12°46'5 S, 45°15'5 E, 3-8m, (1 spm); st. 70, Mayotte, 12°34'6 S, 45°5'2 E, 10-20m, (5 spms).

Zafra troglodytes (Souverbie, 1866). Fig. 33.

Tulear: 14 lots without mention of depth; Nosy-Bé: 1 lot, on the reef, 5 m.

Genus *Seminella* Pease, 1868.

Shell small, bearing axial ribs and fine spiral sculpture; denticles inside outer lip.

Seminella peasei (Von Martens & Langkavel, 1871). Fig. 34.

One of the most variable species of Columbellidae, in colour pattern. Synonymy as follows:

Cythara varia Pease, 1860. (Type locality: Sandwich Islands (=Hawaii).
Columbella nana Dunker, 1871(*Non* Duclos, 1840). (Type locality: Viti Island).
Columbella (Seminella) peasei Von Martens & Langkavel, 1871. (Type locality: Hawaii).
Columbella nanisca Hervier, 1899. (Type locality: Lifu, New Caledonia).
Columbella nanisca var. *subobscura* Hervier, 1899. (Type locality: Lifu, New Caledonia).
Columbella nanisca var.*hyacincta* Hervier, 1899. (Type locality: Lifu, New Caledonia).
Columbella nanisca var.*zebriolata* Hervier, 1899. (Type locality: Lifu, New Caledonia)
Columbella nanisca var.*violacea* Hervier, 1899. (Type locality: Lifu, New Caledonia)
Columbella nanisca var. *parthenica* Hervier, 1899. (Type locality: Lifu, New Caledonia).
Columbella nanisca var. *respersa* Hervier, 1899. (Type locality: Lifu, New Caledonia).
Columbella nanisca var. *diastata* Hervier, 1899. (Type locality: Lifu, New Caledonia).
Columbella roseotincta Hervier, 1899. (Type locality: Lifu, New Caledonia).

Records : Tulear: 17 lots without mention of depth; BENTHEDI st. 5, Banc du Leven, 12°32' S, 47°40'2 E, 35-150m, (1 spm); st. 8, Glorieuses, 11°29'2 S, 47°18'2 E, 250m, (1 spm); st. 14, Banc du Geyser, 12°22 S, 46°23'7 E, 5-20m, (4 spms); st. 24, Mayotte, 12°37' S, 45°9'9 E, 16-18m, (1 spm); st. 34, Glorieuses, 11°32'2 S, 47°16'4 E, 450m, (1 spm); st. 35, Mayotte, 12°52'1 S, 45°16'2 E, 3-30m, (1 spm); st. 70, Mayotte, 12°34'6 S, 45°5'2 E, 10-20m, (5 spms); st. 106, Banc de la Zélée, 12°25'5 S, 46°16'3 E, 18-24m. (2 spms); st. 110, Banc de la Zélée, 12°25'6 S, 46°16'2 E, 24m, (3 spms).

Seminella saviniae (Viader, 1951). Fig. 35.

Tulear: 9 lots wihout mention of depth.

Genus *Mokumea* Habe, 1991.

Shell fusiform, thin, smooth and polished; surface decorated by oblique stripes and white spiral zones.

Mokumea parvula (Viader, 1951). Fig. 36.

Tulear, 1 lot, without mention of depth.

Mokumea zeleensis n.sp. Fig. 37-38.

Description.

Heigth of spire equal to aperture. Shape fusiform. Shell of 4 whorls, with indistinct protoconch, and rounded apex. Whorls slightly convex. Outer surface smooth, except for 11 spiral ridges on base of body-whorl. Columella and outer lip smooth. Colour plain pale brown except for one porcelaineous-white narrow spiral band just under suture.

Dimensions.

Holotype heigth 2.8 mm, breadth 1 mm. Paratype 1 heigth 1.5 mm, breadth 0.6 mm. Paratype 2 heigth 2.5 mm, breadth 1 mm. Paratype 3 heigth 2.1 mm, breadth 0.8 mm.

Remarks.

This species differs from *Mokumea parvula* (Viader, 1951) described from Mauritius, in its more slender shape, in the more numerous spiral cords on base (11 instead of 6) and in its colour plain brown. It differs from *Mokumea divaricata* (Pilsbry, 1904) described from Japan, in its more slender shape, in the more numerous spiral cords on base, in the lack of columellar fold, and in its colour plain brown. Furthermore it differs from *Mokumea albovittata* (Lopez, Coelho and Cardoso, 1965), described from Brazil, in the above characters.

Type material.

Holotype and paratypes 1-2 in the Muséum National d'Histoire Naturelle, Paris. paratype 3 in the collection of J. Drivas.

Type locality.

Holotype and paratype 1 from Banc de la Zélée, BENTHEDI st. 110 R, 12°25'6 S, 46°16'2 E, 24m.

Other material.

Paratype 2 from Mayotte, BENTHEDI st. 35, 12°52'1 S, 45°16'2 E, 3-30m. Paratype 3 off Praslin island, Seychelles, 24 m , collected by J. Drivas.

Etymology.

Named after the "Banc de la Zelée", Indian Ocean, the type locality.

Genus *Zafrona* Iredale, 1916.

Shell with a large smooth protoconch; teleoconch whorls sculptured with axial ribs crossed by spiral cords; outer lip and columella denticulate.

Zafrona isomella (Duclos, 1840). Fig. 39.

This species is quite variable in colour pattern. Synonymy:

Colombella isomella Duclos, 1840. (Type Locality Reunion, by subsequent designation, DRIVAS & JAY 1990).

Columbella isomella var. *notata* Hervier,1899. (Type locality: Lifu, New Caledonia).
Columbella isomella var. *transversa* Hervier,1899. (Type locality: Lifu, New Caledonia).
Columbella isomella var. *subfelina* Hervier,1899. (Type locality: Lifu, New Caledonia).
Pyrene retiaria Tomlin,1931. (Type locality: Port Shepstone, South Africa).

Records : Tulear. BENTHEDI st. 14, Banc du Geyser, 12°22 S, 46°23'7 E, 5-20m, (2 spms); st. 56, Mayotte, 12°53'5 S, 44°57'1 E, 3-5m, (1 spm).

Genus ***Aesopus*** Gould, 1860.

Shell characterized by the high spire, slender shape, and the low, bulbous protoconch.

Aesopus spiculus (Duclos, 1840). Fig. 40.

Tulear, 4 lots, without mention of depth.

Addendum. In addition to the Benthedi-Thomassin material, the authors have found in Nosy-Bé island, Madagascar, at the depth of 15 m, specimens of 2 additional species, that were quoted in the previous lists of Dautzenberg and von Martens, but were not collected in the Benthedi-Thomassin material, namely:

Pyrene tankervillei (Hervier, 1899), *Euplica azora* (Duclos, 1840).

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RÉFÉRENCES

BIELER,R. 1987. Die Gattungen der Architectonicidae, Teil 4: *Heliacus* (*Pyrgoheliacus*) n.subgen. und *Architectonica* (*Adelphotectonica*) n. subgen. *Arch. Moll.* 117: 203-215.

BRATCHER, T. & W.O. CERNOHORSKY. 1982. Six new species of Indo-Pacific Terebridae (Gastropoda). *Nautilus* 96(2): 61-66.

CERNOHORSKY, W. O. 1982 ("1981"). On a collection of Buccinacean and Mitracean Gastropoda (Mollusca, Neogastropoda) from the Mozambique Channel and New Caledonia. *Bull.Mus. Hist. Nat. Paris* (4)3 (section A4): 985-990.

DAUTZENBERG, Ph. 1893. Contribution à la faune malacologique des Iles Seychelle. *Bull. Soc. Zool. France* 18: 78-84

DAUTZENBERG, Ph. 1932. Mollusques testacés marins de Madagascar. Supplément. *Journ. Conch.* 76: 5-119.

DRIVAS, J. & M. JAY. 1990. The Columbellidae of Reunion (Mollusca: Gastropoda). *Ann. Natal Mus.* 31: 163-200.

HEDLEY, C. 1899. The mollusks of Funafuti - Part 1 - Gastropoda. *Mem. Austr. Mus.* 3: 395-510.

KAAS, P. 1985. Chitons (Mollusca: Polyplacophora) procured by the French Benthedi- expedition, 1977, and the MD32-Reunion-expedition, 1982, in the Southwestern Indian Ocean. *Zool. Meded.* 59(26): 321-340.

LELOUP, E. 1981. Chitons du sud-ouest de l'Océan Indien. *Bull.Inst. Roy. Sci. Nat. Belg.* 53(10): 1-4.

LOPEZ, H. S, P. CARDOSO & A. COELHO. 1965. Una nova especie brasilena do genero *Mitrella* Risso. *Rev. Bras. Biol.* 25(1): 21-34.

PILSBRY, H. A. 1904. New Japanese Marine Mollusca. Gastropoda. *Proc. Acad. Nat. Scienc. Philadelphia* 56: 3-37.

PEYROT-CLAUZADE, M. 1977. Faune cavitaire mobile des platiers coralliens de la région de Tuléar (Madagascar). *Thèse Université Aix-Marseille* : 198 pp. + annexes.

SMITH, E.A. 1910. On South African marine mollusca with descriptions of new species. *Ann. Natal Museum* 2(2): 175-220.

SOUVERBIE, M. & R. P. MONTROUZIER. 1866. Description d'espèces nouvelles de l'archipel calédonien. *Journ. Conchyl.* 14: 138-151.

THOMASSIN, B. 1978. Peuplement des sédiments coralliens de la région de Tuléar (S. W. de Madagascar) et leur insertion dans le contexte côtier Indo-Pacifique. *Thèse Université Aix-Marseille* : 494 pp. + annexes.

VIADER, R. 1951. New and unrecorded shells from Mauritius and its dependancies. *Mauritius Inst. Bull.* 3(2): 127-155.

VON MARTENS, E. 1880. Mollusken in Moebius K. *Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen* Berlin, Gutmann : 181-352.

VON MARTENS, E. & B. LANGKAVEL. 187I. *Donum Bismarkianum Eine Sammlung von Sudsee Conchylien*. Berlin, Berggold : 74pp.

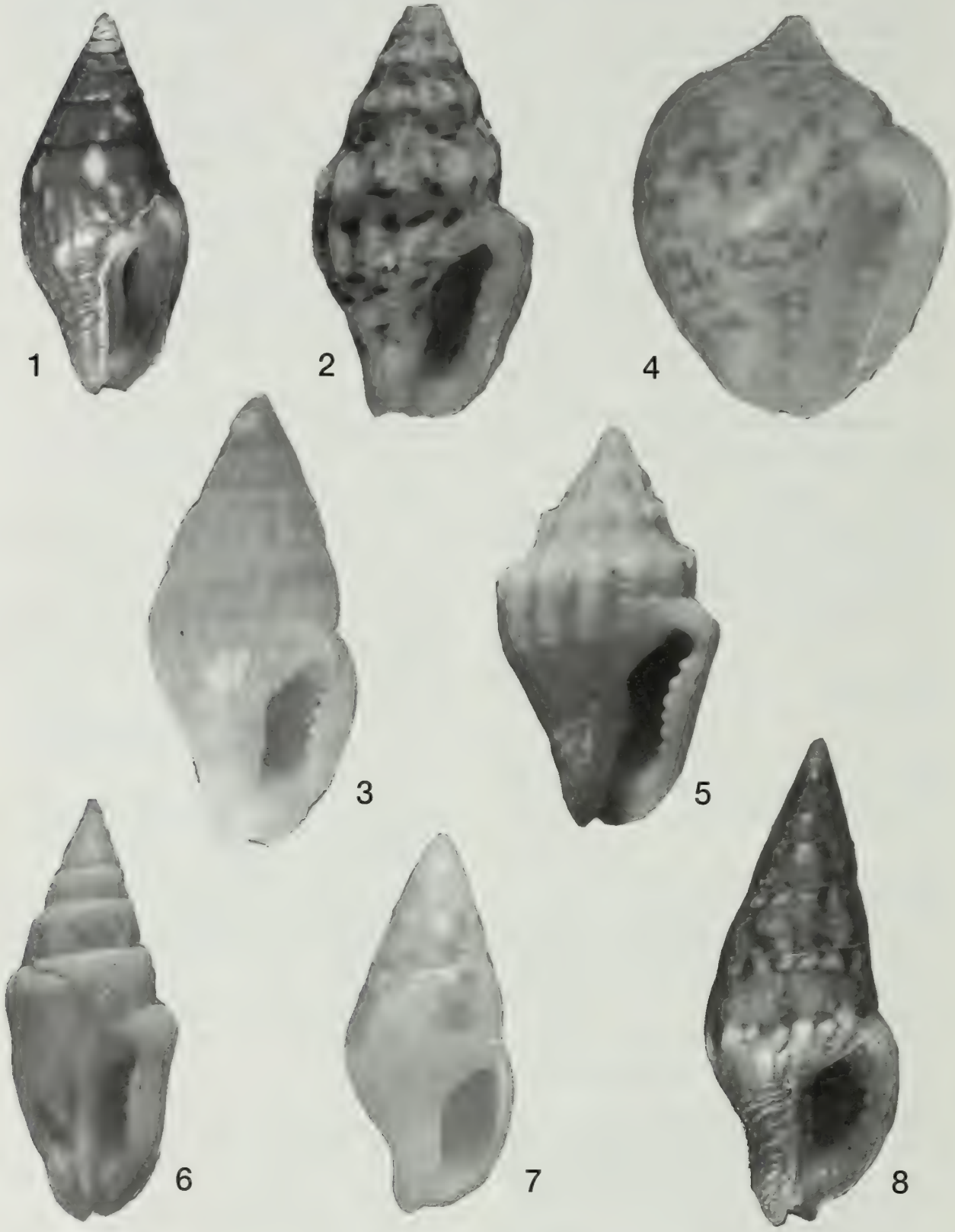

Fig. 1: *Pyrene flava* (Bruguière, 1789) : 20 mm. **Fig. 2**: *Euplica festiva* (Deshayes in Laborde & Linant, 1834) : 10 mm. **Fig. 3**: *Euplica ionida* (Duclos, 1840) : 6 mm. **Fig. 4**: *Euplica turturina* (Lamarck, 1822) : 13 mm. **Fig. 5**: *Euplica varians* (Sowerby, 1832) : 8 mm. **Fig. 6**: *Mitrella albina* (Kiener, 1841) : 13 mm. **Fig. 7**: *Mitrella albuginosa* (Reeve, 1859) : 8.8 mm. **Fig. 8**: *Mitrella conspersa* (Gaskoin, 1851) : 10 mm.

Fig. 9: *Mitrella floccata* (Reeve, 1859) : 13.3 mm. **Fig. 10**: *Mitrella goubini* (Hervier, 1899) : 5 mm. **Fig. 11**: *Mitrella innocens* (Thiele, 1925) : 5.4 mm. **Fig. 12**: *Mitrella margarita* (Reeve, 1859) : 8 mm. **Fig. 13**: *Mitrella moleculina* (Duclos, 1840) : 6 mm. **Fig. 14**: *Mitrella nympha* (Kiener, 1841) : 10mm. **Fig. 15**: *Mitrella rorida* (Reeve, 1859) : 6 mm. **Fig. 16**: *Mitrella seychellarum* (Von Martens, 1904) : 9.5 mm.

Fig. 17: *Mitrella venulata* (Sowerby, 1894) : 10 mm. **Fig. 18**: *Pyreneola cincinnata* (Von Martens, 1880) : 4 mm. **Fig. 19**: *Pyreneola melvilli* (Hedley, 1835) : 5.3 mm. **Figs. 20 - 21**: *Pyreneola lozoueti* n.sp. Holotype : 4.4 mm x 1.5 mm, MNHN, Paris. **Fig. 22**: *Pyreneola shepstonensis* (Smith, 1910) : 5 mm. **Fig. 23**: *Indomitrella puella* (Sowerby, 1844) : 11 mm. **Fig. 24**: *Pleurifera suzannae* (Drivas & Jay, 1990) : 5 mm.

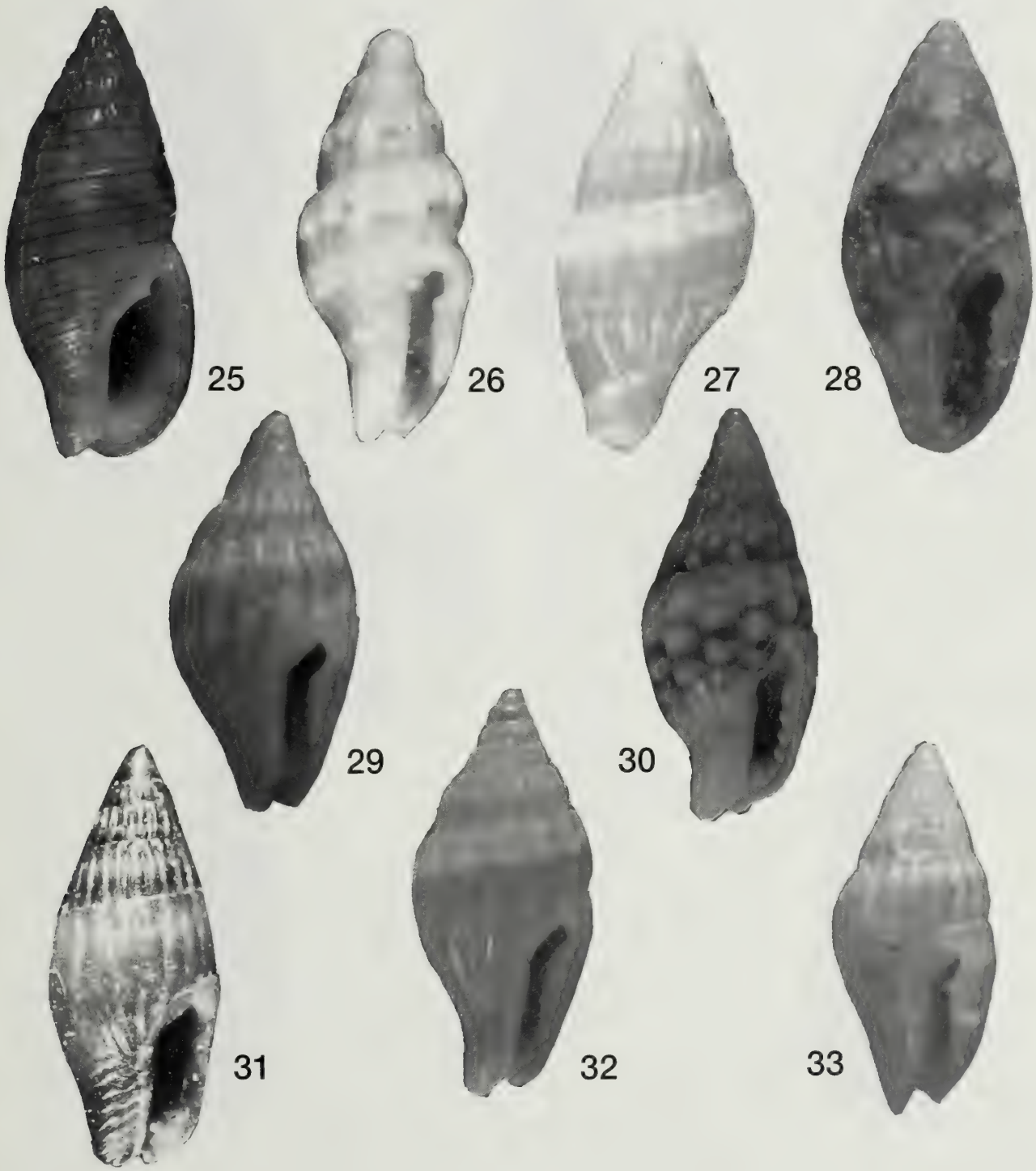

Fig. 25: *Metanachis marquesa* (Gaskoin, 1851) : 11 mm. **Figs. 26-27**: *Zafra geyserensis* Holotype : 2 mm x 0.6 mm, MNHN, Paris. **Fig. 28**: *Zafra morini* (Viader, 1938) : 3 mm. **Fig. 29**: *Zafra obesula* (Hervier, 1899) : 3.8 mm. **Fig. 30**: *Zafra ocellatula* (Hervier, 1899) : 4.5 mm. **Fig. 31**: *Zafra minuscula* (Gould, 1860) : 2 mm. **Fig. 32**: *Zafra succinea* (Hervier, 1899) : 5 mm. **Fig. 33**: *Zafra troglodytes* (Souverbie, 1866) : 5 mm.

Fig. 34: *Seminella peasei* (Von Martens & Langkavel, 1871) : 3 mm. **Fig. 35**: *Seminella saviniae* (Viader, 1951) : 2 mm. **Fig. 36**: *Mokumea parvula* (Viader, 1951) : 2.5 mm. **Figs. 37-38**: *Mokumea zeleensis* n.sp. Holotype : 2.8 mm x1 mm, MNHN, Paris. **Fig. 39**: *Zafrona isomella* (Duclos, 1840) : 5 mm. **Fig. 40**: *Aesopus spiculus* (Duclos, 1840) : 14 mm.

Three new species of Gastropoda from deep water off the Philippines

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KEYWORDS. Gastropoda, Trochidae, Mitridae, Philippines.

ABSTRACT. Three new gastropod species from deep water off the Philippines, are described; one of them, which generic placement has not been positively ascertained, is tentatively assigned to the genus *Eumitra* Tate, 1889.

I. INTRODUCTION

Through the courtesy of Mr. Emmanuel Guillot de Suduiraut during the last two years I had the opportunity of examining several species from his tangle nets operating in the central-southern range of the Philippine Archipelago at 100-600m depth. After investigation, some of the species prove to be new to science and three of these are described here.

II. SYSTEMATICS

Genus: ***Calliostoma*** Swainson, 1840

Type species: *Trochus conulus* Linnaeus, 1758

Subgenus: ***Ampullotrochus*** Monterosato, 1890

Calliostoma (Ampullotrochus) suduirauti n. sp.
Figs 1-4

Description.

Shell light and thin in structure, small for the genus, up to 15 mm in length, with a trochiform outline. Protoconch of about one whorl, showing a faveolate sculpture with weakly prominent, blunt sides of the hexagonal cells; teleoconch starting abruptly with a varix and consisting of 7 flat sided whorls with a strong keel at the whorl periphery bearing serrate, round pointed triangular nodules. Spire extended, slightly coeloconoid and produced at an apical angle of about 60°, suture indistinct. Aperture subquadrate, base moderately convex, outer lip thin, truncate at the base, inside showing the tracing of outer spirals. Columella smooth, thickened, gently oblique, umbilicus not completely closed by the columellar callus. Sculpture consisting of subequal beaded spiral cords evenly spaced above peripheral keel, numbering 2 on first teleoconch whorl, increasing to 5 on last adult whorl; beads on the early whorls are axially connected by blunt riblets which get progressively weaker, almost disappearing after the fourth teleoconch whorl. Minor additional ridges in the interspaces of main cords, several thick and hardly visible growth striae. Ground colour brownish with bronze hues, axial flammules of a darker nuance evenly distributed on teleoconch whorls; peripheral keel nodules arranged in alternate white and brown couples. Base white, bearing 9 or 10 beaded concentric cords with articulate pattern of white and brown dashes, disposition of beads produces thin and arched radial furrows; some secondary spirals between main ones. Inside of mouth and columella nacreous.

Type material.

Holotype : 14.1x12.4mm, MNHN-Paris, paratype 15x11.8mm, Emmanuel Guillot de Suduiraut collection.

Type locality.

Balicasag Island, Bohol, Central Philippines; fished by tangle nets, 140m.

Discussion.

KOSUGE (1984) described a new species and reported new locality records for two others from the Philippines, all belonging to *Benthastelena* (=*Tristichotrochus*, Ikebe, 1942) (MARSHALL, 1995) a typical subgenus of Southern Japan waters. *C. suduirauti* resembles *C. tosaensis* (Kuroda & Habe, 1961), *C. paucicostatum* Kosuge, 1984 and *C. soyoae* Ikebe, 1942, especially the latter two, but differs by having a stronger peripheral keel, brighter coloration and smaller size. *C. suduirauti* also resembles the mediterranean *C. gubbiolii* Nofroni, 1984, but differs in having a stronger peripheral keel and showing an even periferal outline instead of a wavy one.

Etymology.

The new species is named in honour of Mr. Emmanuel Guillot de Suduiraut, experienced conchologist and supplier of valued malacological material from the Philippines.

Genus: ***Mitra*** Lamarck, 1798

Subgenus: ***Mitra*** Lamarck, 1798

Type species: *Mitra mitra* (Linnaeus, 1758)

Mitra (Mitra) nadayaoi n. sp.
Figs 5-6

Description.
Shell up to 30.05mm in length, fusiform-elongate; protoconch missing, teleoconch of 8/9 slightly convex whorls, separated by a grooved, marginated suture. Spiral sculpture consisting of finely incised and punctate threads equally distributed, numbering 4 on the spire whorls and 18/20 on body whorl plus siphonal canal; axial disposition of pits producing a weakly beaded surface; thick and weak axial growth lines present. Aperture high, more than half total length, and narrow, little widening out in the middle; outer lip strengthened by a weak margin, inside crenulated. 4 oblique columellar folds growing stronger adapically; columellar callus thin, bright and transparent. Siphonal canal open, well developed and hardly dorsally projected. Background colour pink-beige on body whorl, tending to chestnut-brown on spire and to pink on peristome; upper part of spire and columellar folds whitish, sutural girdle patterned with articulate white and brownish dashes.

Type material.

Holotype : 26.9x9.65mm, MNHN, paratype 30.05x 10.6mm, Emmanuel Guillot de Suduiraut collection.

Type locality.

Balut Island, Mindanao, Philippines, fished by tangle nets, -240 m on sandy, muddy and stony bottom; sympatric with *Mitra isabella* Swainson, 1831 and *Mitra pele* Cernohorsky, 1970. Holotype live taken, paratype crabbed.

Discussion.

M. nadayaoi is related to *M. subflava* (Kuroda & Habe, 1971), but differs in the smaller size, 27mm versus 50mm, in the less slender profile and in the spiral punctations which become obsolete on the body whorl in the second species. *M. nadayaoi* also shows a spiral threads sculpture and an outer lip inside crenulated, both characters not present in *M. subflava*. *M. nadayaoi* resembles *M. sacerdotalis* A. Adams, 1853, mostly in the pattern and colour of sutural girdle, but differs in the smaller size, 27mm versus 60-70mm, in the more developed siphonal canal and in the peristome colour, which is brown in *M. sacerdotalis*; the range of *M. sacerdotalis* is probably limited to the Indian Ocean. H. Turner (pers. com.)

firstly recognized the present species as new in 1995.

Etymology.

Following the wishes of Mr. Emmanuel Guillot de Suduiraut, this species is named in honour of his friend Mr. Daniel Nadayao who collected the specimens.

Genus: ***Eumitra*** Tate, 1889

Type species: *Mitra alokiza* Tenison-Woods, 1880

?***Eumitra suduirauti*** n. sp.
Figs 7-8

Description.
Shell fusiform-elongate; protoconch bulbous and extended consisting of about 2 smooth whorls not easily distinguished from the teleoconch due to erosion; teleoconch of 9 convex whorls, separated by a deep and wide sutural groove with rounded edge. Teleoconch sculpture consisting of rounded axial ribs covering the whole whorl height, and weak spiral cords; sculpture becoming almost obsolete on last two whorls, especially the axial sculpture; 10/11 stronger spiral cords on anterior end; thick and feeble growth markings on teleoconch whorls. Short and open siphonal canal with a clear siphonal fasciole. Aperture ovoid, high, about half total length, with maximum width at 1/3 from anterior end, anal sulcus sharp; outer lip unmarginated, smooth inside, inner lip sinusoidal. Columella weakly bent to the left, bearing a thickening on middle area with 5 feeble, evenly spaced folds, the basal one weaker. Shell colour chalky white.

Type material.

Holotype : 51x17.1mm MNHN, paratype 47.8x 15.6mm, Emmanuel Guillot de Suduiraut collection.

Type locality.

Tanala, Tiain Pt., Northern side of Sarangani Island, Davao del Sur Province, Mindanao, Celebes Sea. By tangle nets, -500/-600 m., volcanic stone bottom; both specimens crabbed, sympatric with *Calliotectum tibiaeforme* f. *johnsoni* (Bartsch, 1942), *Amalda hilgendorfi* (von Martens, 1897) and *Perotrochus vicdani* (Kosuge, 1980).

Discussion.

The present new species is tentatively attributed to *Eumitra* as some shell characters, viz. sculpture and columellar plications, support this generic placement, whereas protoconch shape shows a slight likeness to species of the genus *Charitodoron* Tomlin, 1932 and finally shell size and sutural area conformation seem to exclude it belonging to either genus. LOZOUET (1991) first described four recent species of *Eumitra*, up to that time considered a fossil group related to *Charitodoron* (CERNOHORSKY, 1970); in the same work he reported on the discovery of two new species of *Charitodoron* from the Upper Oligocene deposits of Aquitania and consequently suggested that the assumption of a close relationship between the two genera must be revised, followed in this conclusion

by CERNOHORSKY (1991). If the placement of the new taxon to the genus *Eumitra* is confirmed by future findings of living animals, it would be an important new record, increasing the original range extension to New Caledonia; on this subject, Lozouet (pers. com.) reports that a specimen very close to the ones here studied has been collected during the cruise "Karubar" undertaken by MNHN team in Indonesia. As previously stated, the shell characters of ?*Eumitra suduirauti* do not match completely the standards of the genus and the reported differences clearly separate it from all the species, both recent and fossil, ascribed to *Eumitra*.

Etymology.

This species is named after Mr. Emmanuel Guillot de Suduiraut.

ACKNOWLEDGMENTS. I wish to express my best thanks to E. Guillot de Suduiraut, Cebu, Philippines, R. Salisbury, Idaho, U.S.A., P. Bouchet and P. Lozouet, Muséum National d'Histoire Naturelle, Paris, R. Houart, Landen, Belgium, A. Bianchi, Milano, Italy and my daughter Ilaria for their help and cooperation.

REFERENCES

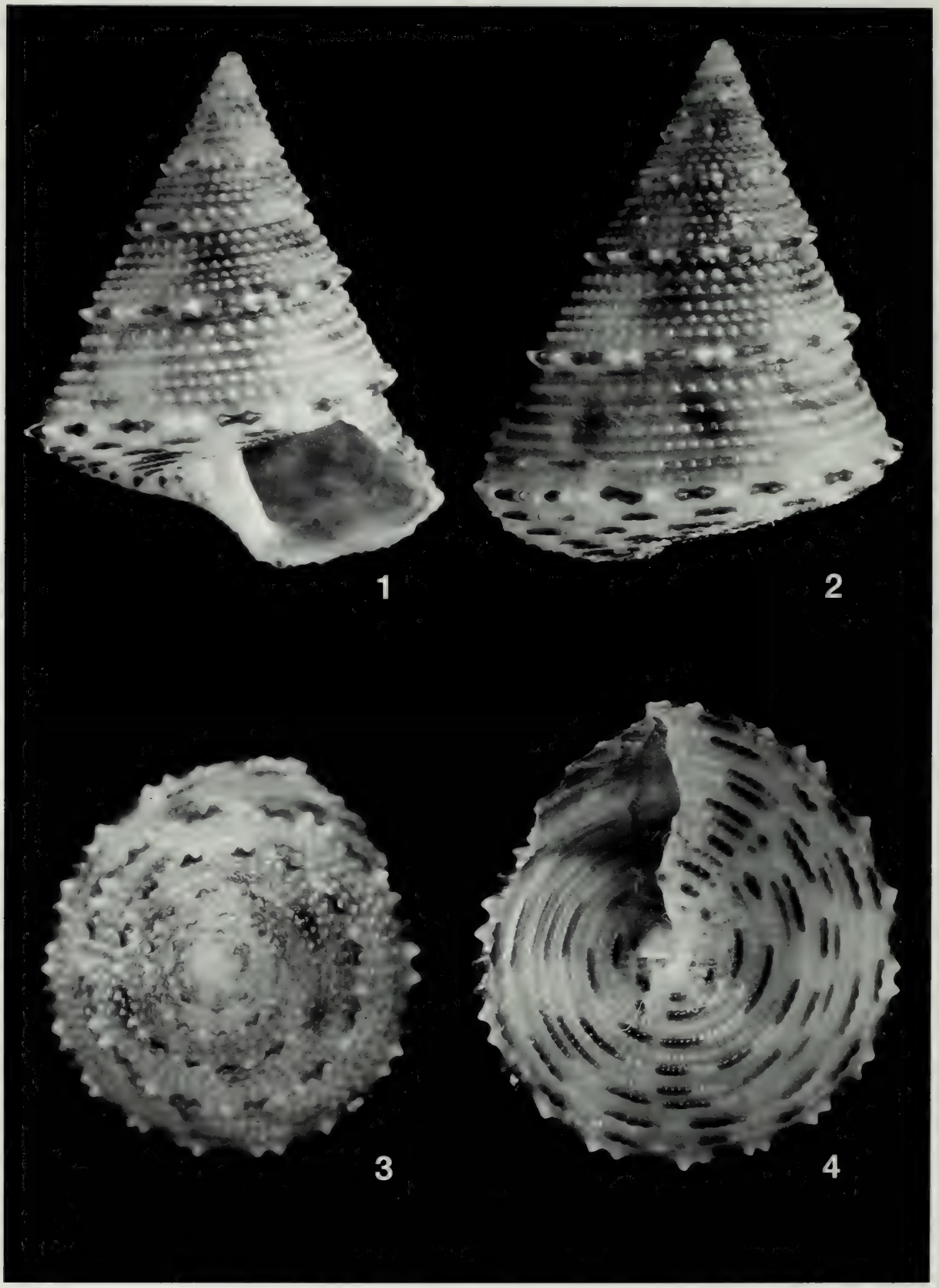
CERNOHORSKY, W.O. 1970. Systematic of the families Mitridae & Volutomitridae (Mollusca: Gastropoda). *Bull. Auckland Inst. Mus.* 8: 1-190.

CERNOHORSKY, W.O. 1991. *The Mitridae of the World. Part 2. The Subfamily Mitrinae Concluded and Subfamilies Imbricariinae and Cylindromitrinae. Monographs of Marine Mollusca.* Trophon Corporation, Silver Spring 4: 1-164.

KOSUGE, S. 1984. Description of a new and five newly recorded species of the genus *Calliostoma* from Philippines (Gastropoda Trochacea). *Bull. Inst. Malac. Tokyo.* 2(1) : 5-6 pl. 2.

LOZOUET, P. 1991. Mollusca Gastropoda : *Eumitra* récentes de la région néo-calédonienne et *Charitodoron* fossiles de l' Oligocène supérieur d' Aquitaine (Mitridae). *In* : A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 7. *Mém. Mus. natn. Hist. nat.* (A) 150: 205-222.

MARSHALL, B.A. 1995. Calliostomatidae from New Caledonia, The Loyalty Islands and the northern Lord Howe Rise. *In* : A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM. *Mém. Mus. natn. Hist. nat.* 167: 381-458.



Figs. 1-2-3-4. *Calliostoma suduirauti* sp. n., holotype MNHN, 14.1mm.

Figs. 5-6. *Mitra nadayaoi* sp. n., holotype MNHN, 26.9mm.

Figs. 7-8. *?Eumitra suduirauti* sp. n., holotype MNHN, 51mm.

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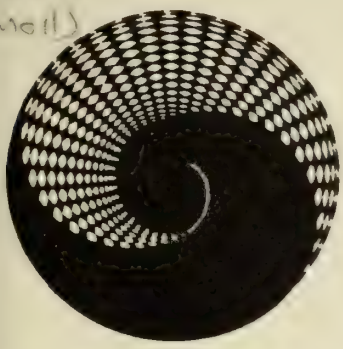

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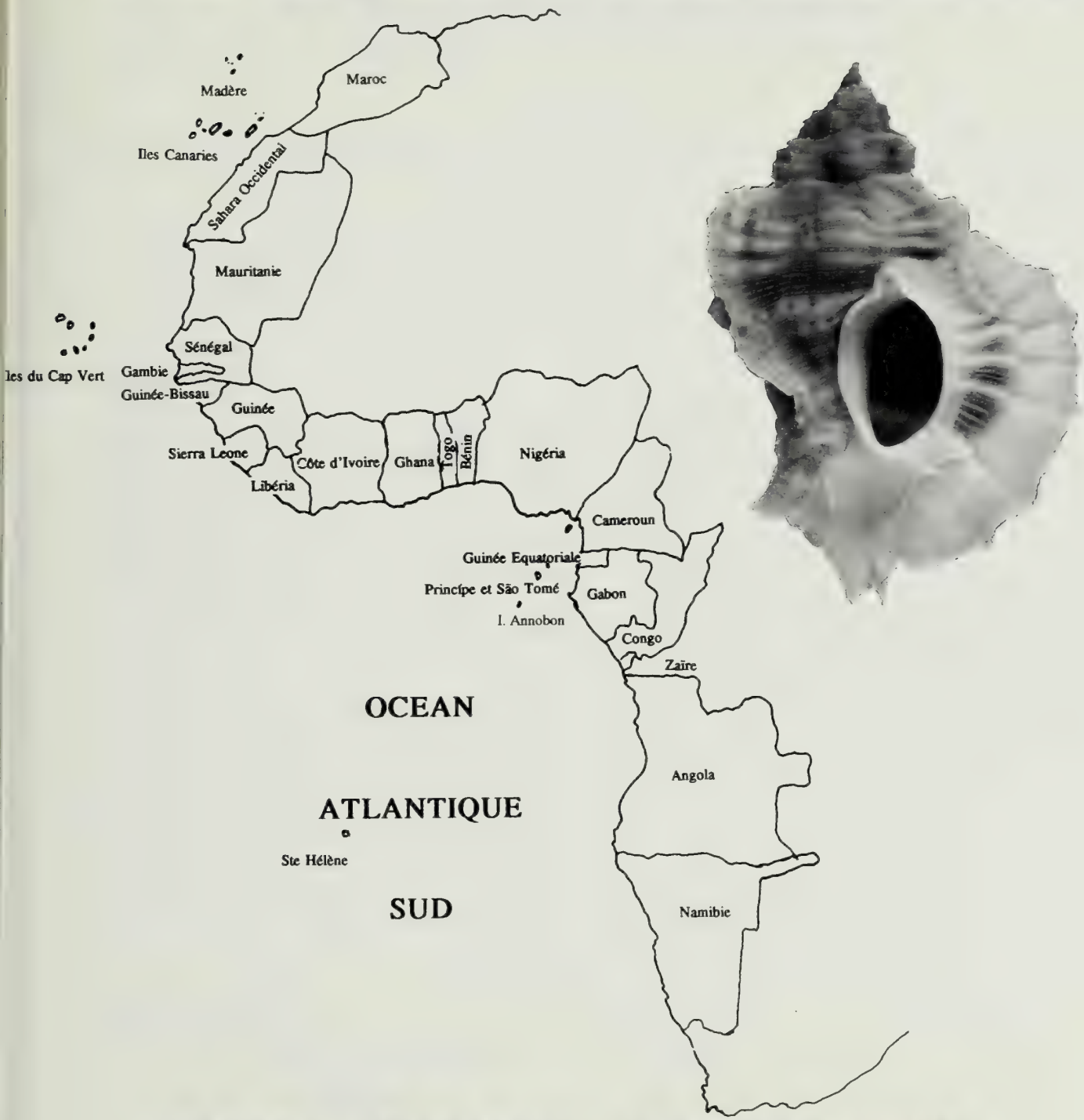

THE WEST AFRICAN MURICIDAE

Roland HOUART

Les Muricidae d'Afrique occidentale
The West African Muricidae

II. Ocenebrinae, Ergalataxinae, Tripterotyphinae, Typhinae, Trophoninae & Rapaninae

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MOTS-CLEFS. Mollusca, Gastropoda, Muricidae, Afrique Occidentale, Révision.

KEYWORDS. Mollusca, Gastropoda, Muricidae, West Africa, Revision.

AVANT-PROPOS

La première partie de cet article est paru dans APEX, Vol. 11 (3-4) (HOUART, 1996b). Elle contient le résumé, l'introduction, les remerciements et l'analyse systématique des sous-familles Muricinae et Muricopsinae. La deuxième partie reprend les autres sous-familles ainsi que les espèces de l'Ile de Sainte Hélène et la bibliographie.

Un important résumé en anglais suit le texte français dans les deux parties.

***

FOREWORD

The first part of this paper was published in APEX, Vol. 11 (3-4) (HOUART, 1996b). It contains the abstract, the introduction, the acknowledgements, and the systematic account of Muricinae and Muricopsinae. The second part contains the other subfamilies, the Muricidae of the Island of Saint Helena, and the bibliography.

An English abstract follows the French text in both parts.

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(* denotes synonym or homonym)

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SYSTEMATIQUE
SYSTEMATIC ACCOUNT

III. OCENEBRINAE Cossmann, 1903

En Afrique Occidentale, La sous-famille des Ocenebrinae est représentée par quatorze espèces ou sous-espèces, dont trois espèces européennes et/ou méditerranéennes qui atteignent leur limite Sud de répartition au Nord de la région étudiée: *Ocenebra (Ocinebrina) aciculata* (Lamarck, 1822), *O. (O.) edwardsi* (Payraudeau, 1826) et *O. (O.) miscowichae* (Pallary, 1920).

La plupart des espèces sont infralittorales et vivent sur de petits substrats solides, même dans un environnement général plus sableux ou sablo-vaseux.

Trois espèces d'*Ocenebra* et une espèce de *Chicocenebra* possèdent une protoconque multispirale indiquant un développement larvaire planctotrophe: *Ocenebra coseli*, Houart, 1989, *O. inermicosta* (Vokes, 1964), *O. isaacsi* Houart, 1984 et *Chicocenebra gubbi* (Reeve, 1849). La protoconque est paucispirale (développement lécitotrophe) ou inconnu chez les autres espèces.

Du matériel topotypique de *Ocinebrina adansoni* Kosuge et Fernandes, 1989, décrit de l'Ile de São Tomé a été examiné, comme ROLÁN & FERNANDES (1991) je classe cette espèce chez les Coralliophilidae.

***

The subfamily Ocenebrinae in West Africa includes fourteen species and subspecies; most of them are infralittoral and lives on hard substratum. Three species of *Ocenebra* and one species of *Chicocenebra* have a multispiral protoconch, attesting to planktotrophic larval development: *Ocenebra coseli* Houart, 1989, *O. inermicosta* (Vokes, 1964), *O. isaacsi* Houart, 1984, and *Chicocenebra gubbi* (Reeve, 1849). The protoconch is paucispiral (lecitotrophic larval development) or unknown in the other species.

Extensive material of topotypic specimens of *Ocinebrina adansoni* Kosuge & Fernandes, 1989 has been examined. I conclude, like ROLÁN & FERNANDES (1991), that the species is a Coralliophilidae.

Three European and/or Mediterranean species are present at the northern end of the studied area: *Ocenebra (Ocinebrina) aciculata* (Lamarck, 1822), *O. (O.) edwardsi* (Payraudeau, 1826), and *O. (O.) miscowichae* (Pallary, 1920).

Genre *Ocenebra* Gray, 1847

Sous-genre: *Ocenebra* Gray, 1847

Espèce-type: *Murex erinaceus* Linnaeus, 1758, par monotypie.

Ocenebra (Ocenebra) coseli Houart, 1989
Figs 165-166, 180, 198-199

Ocenebra coseli Houart, 1989: 63, figs 1-2, 5-6

Matériel type examiné: Holotype MNHN.

Localité type: Pointe Idolo, Cap Esterias, Gabon.

Distribution: Du Gabon au nord de l'Angola, littoral.

Remarques: *Ocenebra coseli* est sympatrique, et généralement microsympatrique (même habitat) avec *O. isaacsi* et *O. inermicosta*.

Ocenebra coseli et *O. isaacsi* ont en commun une protoconque multispirale pourvue d'une forte carène spirale. Ce caractère indique peut-être un lien de parenté étroit. *O. isaacsi* est reconnaissable à sa sculpture spirale plus fine, plus squameuse, à ses varices plus élaborées et à son ouverture pourvue d'un canal anal très large et profond.

Ocenebra inermicosta atteint une taille adulte plus grande (jusque 40 mm), pour 6 tours de téléoconque. La forme générale de la coquille est plus globuleuse, son ouverture est plus large et son canal siphonal fermé, sauf chez les coquilles juvéniles. Les très jeunes individus peuvent être séparés par leur nombre de tours de téléoconque moins nombreux et par leur protoconque légèrement plus large, bicarénée chez *O. inermicosta*, monocarénée chez *O. coseli*.

La coquille est noire, brunâtre ou gris-bleuté, elle atteint 13 mm.

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Ocenebra coseli is sympatric, and generally microsympatric (same habitat) with *O. isaacsi*, and *O. inermicosta*. *O. coseli* and *O. isaacsi* have a similar multispiral, keeled protoconch that could indicates strong relationship. *Ocenebra isaacsi* has a finer, more squamous spiral sculpture, expanded wings, and the aperture with broad and deep anal notch.

Ocenebra inermicosta is relatively larger (up to 40 mm in length), more globose, with a larger aperture and sealed siphonal canal in adult specimens. Young specimens of *O. inermicosta* may be separated from adults of *O. coseli* in the less numerous teleoconch whorls, and in the weakly broader, bicarinate protoconch, whereas the protoconch of *O. coseli* has a single keel. Shell up to 13 mm in length, black, brownish or blueish-grey.

Ocenebra (Ocenebra) inermicosta (Vokes, 1964)
Figs 167-168, 182, 202-204 et couverture

Murex fasciatus Sowerby, 1841: 144; 1841b: pl. 192, fig. 86 (non *M. fasciatus* Gmelin, 1791)

Tritonalia inermicosta Vokes, 1964: 20 (n.n. for *Murex fasciatus* Sowerby)

Matériel type examiné: 3 syntypes BMNH 197497.

Localité type: " ad oras Africanas -river Gambia- ".

Distribution: Du Sahara Occidental à l'Angola; de 0 à 20 m, sous les blocs ou sur le sable vaseux.

Remarques: La protoconque, multispirale et bicarénée, indique un développement larvaire planctotrophe. La téléoconque, globuleuse, par sa sculpture noduleuse, et son canal siphonal fermé chez les spécimens adultes, est immédiatement reconnaissable parmi les Muricidae ouest-africains. L'espèce est variable et peut présenter une coquille avec des varices arrondies ou rarement avec une expansion foliacée très prononcée (Fig. 24 & couverture).

La taille adulte varie de 18 à 40 mm, la couleur varie du brun clair au gris-bleuté, occasionnellement avec des bandes spirales plus claires.

***

The bicarinate, multispiral protoconch indicates planktotrophic larval development. The siphonal canal is sealed in adult specimens. The shell morphology is variable, varices may be more or less rounded, or rarely winged (Fig. 24 & cover). From 18 to 40 mm in length, pale brown or bluish-grey, occasionally with paler spiral bands.

Ocenebra (Ocenebra) isaacsi Houart, 1984
Figs 169-170, 183, 200-201, 253

Ocenebra isaacsi Houart, 1984: 83, figs 1-8

Matériel type examiné: Holotype IRSNB 26716/404.

Localité type: Prampram, Ghana.

Distribution: Du Ghana à l'Angola, littoral, sur les rochers et les rochers couverts de sable fin limoneux.

Remarques: L'ouverture denticulée intérieurement, le canal siphonal ouvert et l'opercule à nucleus basal paraissent à première vue atypiques pour un *Ocenebra*.

Ocenebra isaacsi est certainement congénérique avec *O. coseli* et présente également une radula avec une dent centrale proéminente et des cuspides latéraux flanqués de cuspides accessoires sur leur bord externe, typique des Ocenebrinae. La protoconque est multispirale et monocarénée.

Ocenebra isaacsi atteint une taille adulte de 8 à 17,3 mm. La coquille est gris-bleuté à brunâtre, souvent recouverte d'un encroutement carbonaté qui ne paraît pas constituer un intritacalx.

***

The weakly denticulate aperture, the open siphonal canal, and the operculum with basal nucleus are atypical features for the Ocenebrinae. *O. isaacsi* is certainly congeneric with *O. coseli* whith the same radula morphology, typical for Ocenebrinae and a similar protoconch morphology.

Shell from 8 to 17.3 mm in length, bluish-grey to brownish, often covered with a fine calcareous layer, which does not seems to be an intritacalx.

Ocenebra (Ocenebra) gruveli (Dautzenberg, 1910)
Figs 171, 186, 205-206

Trophon gruveli Dautzenberg, 1910: 60, pl. 2, figs 9, 10

Matériel type examiné: Holotype MNHN.

Localité type: Cansado, Mauritanie.

Distribution: Sud du Sahara Occidental et Mauritanie, 6-84 m.

Remarques: Décrite comme *Trophon*, et depuis lors classée chez les Trophoninae, cette espèce, bien que possédant un canal siphonal ouvert, possède une radula typiquement ocenebrine (Fig. 171). Sa classification dans le genre *Ocenebra* est peut-être provisoire. L'espèce est petite, atteignant la taille de 14 mm. Coquille ocre ou brun clair.

***

Described as a *Trophon*, and since then classified in Trophoninae, the species has a shell with an open siphonal canal, but with a typical ocenebrine radula (Fig. 171). Its classification in the genus *Ocenebra* is tentative. The shell is small, reaching a length of 14 mm. Ochre or pale brown.

Genre *Pteropurpura* Jousseaume, 1880

Espèce-type: *Murex macropterus* Deshayes, 1839, par désignation originale.

Pteropurpura dearmatus dearmatus (Odhner, 1922)
Fig. 210

Murex (*Phyllonotus*) *dearmatus* Odhner, 1922: 13, pl. 1, fig. 21

Matériel type examiné: Holotype Naturhistoriska Mus., Göteborg.

Localité type: Porto Alexander, Afrique Occidentale.

Distribution: L'espèce est uniquement connue de la localité type, Porto Alexander, Angola.

Remarques: voir sous *Pteropurpura dearmatus fairiana* (Houart, 1979).

Pteropurpura dearmatus benderskyi Emerson & D'Attilio, 1979
Figs 163-164, 187, 207-209, 211

Pteropurpura benderskyi Emerson & D'Attilio, 1979: 2, figs 1, 2, 19.

Matériel type examiné: Holotype AMNH 183819.

Localité type: Luanda, Angola, 50 m.

Distribution: L'espèce est connue uniquement de la localité type, Luanda, Angola, 40-90 m.

Remarques: voir sous *Pteropurpura dearmatus fairiana* (Houart, 1979).

Pteropurpura dearmatus fairiana (Houart, 1979)
Figs 184-185, 212-213

Ocenebra fairiana Houart, 1979: 3, figs 1-4.

Matériel type examiné: IRSNB IG 25886/320.

Localité type: Cap Fria, Namibie, 150-160 m.

Distribution: Cap Fria, Namibie, 130-160 m; un spécimen fut récolté par 60 m de fond au large de Luanda, Angola (coll. P. Ryall).

Remarques : Les différences conchyliologiques entre les trois sous-espèces nominales ont été présentées sous forme d'un tableau comparatif (HOUART, 1982). Une nouvelle interprétation de la systématique de ce genre est présenté ici. En effet, la protoconque de *P. dearmata* indique un développement non planctotrophe, et les différences morphologiques entre les trois espèces nominales sont interprétées ici comme résultant, au moins en partie, d'une variation géographique le long de la côte sud-ouest de l'Afrique.

La forme la plus commune de la région de Luanda est caractérisée par l'existence sur chaque tour de 3 varices ornées de courtes épines reliées entre elles par une expansion foliacée: cette forme correspond à l'holotype de *P. benderskyi* (Figs 207-209). Plus rarement, les spécimens de cette région montrent des varices arrondies, ornées de courtes épines, sans expansion foliacée: ces individus sont intermédiaires entre l'holotype de *P. benderskyi* et l'holotype de *P. dearmata* (Fig. 211). Huit cents kilomètres séparent Luanda de Porto Alexander; dans cette zone, aucun dragage n'a été fait dans le circalittoral et l'absence de *P. dearmata/benderskyi* n'y est pas significative. L'holotype de *dearmata* se trouve donc être l'unique exemplaire connu du Sud de l'Angola; il diffère des individus à courtes épines de Luanda par ses varices plus épaisses, portant une très petite épine carinale résiduelle, surtout apparente sur le dernier tour de la spire.

Une nouvelle discontinuité de 300 kms, dont l'importance est peut-être renforcée par la présence de l'estuaire du Cunene, sépare Porto Alexander du Cap Fria. *P. dearmata fairiana* du Cap Fria diffère plus nettement des individus angolais par la présence d'une courte épine carinale nettement dirigée vers l'apex, et située plus près de la suture adapicale; il y a 3 à 6 côtes intervaricales, peu prononcées, entre chaque paire de varices, au lieu des 2 ou 3 côtes bien marquées observées chez *dearmata - benderskyi*. L'ouverture est

proportionnellement plus large, avec un labre lisse, moins épaissi et le canal siphonal est plus large, non rétréci à son extrémité.

Le manque de matériel dans les localités intermédiaires, ainsi que la faiblesse de l'échantillonnage dans le Sud de l'aire de distribution, ne permettent pas de conclure définitivement sur le statut des trois sous-espèces nominales. Les formes *benderskyi* et *dearmata* paraissent cependant très proches. *P. fairiana*, au contraire, diffère par davantage de caractères. En attendant la récolte de matériel de localités intermédiaires, il est possible de désigner chacune des trois formes parapratiques en utilisant la nomenclature trinominale.

La couleur est identique chez les trois sous-espèces: ocre à brun foncé. *P. dearmata dearmata* atteint la taille de 22,1 mm (holotype); *P. dearmata benderskyi* atteint 26,5 mm; *P. dearmata fairiana* atteint 33 mm.

La découverte récente d'un spécimen de *P. fairiana* provenant de Luanda, Angola (coll. P. Ryall) est très intéressante. Si sa présence en Angola se confirme, il conviendrait certainement de revoir la classification proposée ici pour *P. fairiana*.

***

The differences in the shell morphology in these three nominal subspecies were noted by HOUART (1982). A new interpretation is given here. The protoconch of *Pteropurpura dearmatus* is paucispiral, attesting non-planktotrophic larval development, and the differences in shell morphology are perhaps due to geographical variations along the Southwest African coast. The commonest form from off Luanda, *Pteropurpura dearmatus benderskyi* is characterized by its trivaricate shell morphology with webbed varices (Figs 207-209). Another form has rounded varices and a small, single, carinal spine. This form seems to be intermediate between the holotype of *P. benderskyi* and the holotype of *P. dearmatus* (Fig. 211). No intensive research has taken place between Luanda and Porto Alexander, separated by 800 kms, and the absence of *P. dearmatus/benderskyi* in this zone is not significative. *P. dearmatus dearmatus* differs from the *benderskyi* form with small carinal spines in having broader varices with a short, residual, carinal spine, especially apparent on the last teleoconch whorl.

Some 300 kms more, including the Cunene estuary, separate Porto Alexander from Cape Fria, the type locality of *P. fairiana*. *P. fairiana* is more obviously different from the Angolese populations in its broader, and more rounded first teleoconch whorl, in the short, strongly upward curved carinal spine, in the relatively larger and smoother aperture, and in the broader siphonal canal. There are 3 to 6, low, intervarical ribs in *P. fairiana* instead of 2 or 3 high ribs in *dearmatus - benderskyi*, and the spiral sculpture is narrower, more widely spaced, and more irregular.

The lack of material from intermediate localities, as well as the few known specimens from south of the geographical distribution, do not allow conclusions about the definitive classification of these three taxa. The *benderskyi* and *dearmatus* forms seem to be very close while the *fairiana* form differs by more morphological characters.

It is possible to designate the three taxa using trinominal nomenclature until more material is available for study.

The colour is identical for the three subspecies: ochre to dark brown. *P. dearmatus dearmatus* has a maximum length of 22.1 mm (holotype), *P. dearmatus benderskyi* reachs 26.5 mm, and *P. dearmatus fairiana* reachs 33 mm.

However, the recent discovery of a specimen of *P. fairiana* from Luanda, Angola (coll. P. Ryall) is most interesting. If its presence is confirmed there, the classification proposed here for *P. fairiana* will have to be revised and updated.

Genre *Jaton* Push, 1837

Espèce-type: *Murex decussatus* Gmelin, 1791, par désignation originale.

Les trois espèces récentes du genre *Jaton* sont endémiques à l'Afrique Occidentale, *J. decussatus* (Gmelin, 1791) de la Mauritanie et du Sénégal, *J. flavidus* (Jousseaume, 1874) du Sénégal et *J. sinespina* Vermeij & Houart, 1996 d'Angola. La coquille possède trois larges varices arrondies sur les deux ou trois derniers tours. La sculpture intervaricale est constituée d'un nodule proéminent, orné à sa droite (côté adapertural) de deux solides cordons divergents arrondis. Le cordon supérieur (adapical) forme la forte carène. Dans l'espèce type, *J. decussatus*, un troisième cordon, abapical au nodule, se prolonge vers la varice de l'ouverture et forme un petit denticule labial. Le canal siphonal est large et fermé.

***

The three living species of the genus *Jaton*, all from West Africa, are *J. decussatus* (Gmelin, 1791) (type of the genus), from Mauritania and Senegal, *J. flavidus* (Jousseaume, 1874) from Senegal, and *J. sinespina* Vermeij & Houart, 1996 from Angola. Shells belonging to the genus *Jaton* are characterized by having three thick, usually rounded varices on the last two or three whorls. Intervarical sculpture consists of a prominent node, which on its right (or adapertural) side is adorned with two strong, rounded, divergent cords. The uppermost of these two cords forms the strong shoulder. In the type species *J. decussatus*, a

third cord, abapical of the node, extends across the varix to form a small labral tooth or spine at the edge of the outer lip. The broad siphonal canal is sealed.

Jaton decussatus (Gmelin, 1791)
Figs 188, 216

Murex decussatus Gmelin, 1791: 3527.

Murex jatonus Lamarck, 1816: pl. 418, fig. 1.
Murex hemitripterus Lamarck, 1816: pl. 418, fig. 4.
Murex lingua Dillwyn, 1817: 688.
Murex gibbosus Lamarck, 1822: 166.
Murex linguavervecina Reeve, 1845: pl. 27, fig. 121.

Matériel type examiné: *M. decussatus*: fondé sur des références diverses, dont ADANSON (1757 " le jatou "), dont 7 coquilles adultes et un juvénile sont au MNHN (FISCHER-PIETTE, 1942: 223); *M. hemitripterus*: 2 syntypes MNHN; *M. gibbosus*: 3 syntypes MHNG; *M. jatonus*, *M. lingua* et M. *linguavervecina*: non localisé.

Localité type: *M. decussatus* et *M. lingua*, Afrique de l'Ouest; *M. gibbosus*, Cap Vert (erroné); *M. linguavervecina*, Gorée, Sénégal, 59 m; *M. jatonus* et *M. hemitripterus*, localités types inconnues.

Distribution: du Nord de la Mauritanie jusque Dakar, au Sénégal, du littoral jusqu'à une dizaine de mètres de profondeur. La profondeur de 59 m indiquée par REEVE (1845) pour *M. linguavervecina* est probablement erronée ou basée sur un spécimen trouvé mort.

Remarque: *Jaton decussatus* est caractérisé par la présence d'une petite épine labiale, extension du cordon spiral abapical. L'espèce ressemble à *J. flavidus* en ayant une spire assez basse, elle en diffère cependant par l'absence constante de denticule à l'intérieur de l'ouverture, par la présence d'un petit denticule labial et par ses varices plus arrondies et lisses. La coquille de *Jaton decussatus* atteint 30 à 53 mm, elle est brune ou blanchâtre avec des taches plus foncées. *Jaton decussatus* vit en eau moins profonde que *J. flavidus*.

***

Jaton decussatus is characterized by the presence of a short labral spine, which arises as an extension of the lower cord as it crosses the apertural varix from the right (adapertural) side of the intervarical node. The species resembles *J. flavidus* in having a low spire, but it differs by lacking denticles on the inner side of the outer lip, by possessing a labral spine, and by having much less spinose varices. The shell is brown or white with light or dark brown blotches and reaches an adult length of 30 to 53 mm. *Jaton decussatus* occupies somewhat shallower habitats than does *J. flavidus*.

Jaton sinespina Vermeij & Houart, 1996
Figs 190, 217-219

Jaton sinespina Vermeij & Houart, 1996: 88, figs 1-5, 9, 12.

Matériel type examiné: Holotype MNHN.

Localité type: Angola, Prov. Moçamedes, Lucira (Praia do Cesar).

Distribution: Angola, depuis Moçamedes Bay jusqu'au sud de Benguela, sur rochers infralittoraux, 0-10 m.

Remarques: *Jaton sinespina* diffère de *J. decussatus* par sa spire plus élevée, ses varices plus épaisses et son ouverture plus large. Une dent labiale est présente chez *J. decussatus* mais n'a jamais été observée chez *J. sinespina*. Enfin, la coquille de *J. sinespina* est généralement blanchâtre avec des taches noires. *J. decussatus* possède une coquille brune ou blanchâtre avec des taches plus foncées, jamais noires. Certaines de ces différences ont déjà été observées par RYALL (1984) qui a proposé le nom de *Jaton decussatus* var. *angolensis*. Ce nom est cependant sans valeur nomenclaturale (ICZN art. 16).

***

Jaton sinespina differs from *J. decussatus* and *J. flavidus* in having a higher spire. The varices are thicker, and its aperture is relatively larger than that of the other two Recent species. It differs further from *J. decussatus* in the constant absence of a labral spine, and from *J. flavidus* by a less squamose shell and by the absence of denticles on the inner side of the outer lip. Some of these differences were already noted by RYALL (1984), who proposed the name *Jaton decussatus* var. *angolensis* for this taxon. His name is, however, unavailable (ICZN Article 16).

Jaton flavidus (Jousseaume, 1874)
Figs 189, 220-221

Murex flavidus Jousseaume, 1874: 8.

Murex rusticus Jousseaume, 1874: pl. 1, fig. 7-8.

Matériel type examiné: holotype MNHN.

Localité type: inconnue.

Distribution: L'espèce est uniquement connue du Sénégal, aux environs de Dakar, par 5 à 36 m. de profondeur.

Remarques: JOUSSEAUME (1874) ne décrit (sous le nom de *M. flavidus*) et ne figure (sous le nom de *M. rusticus*) qu'une seule coquille. Deux exemplaires au MNHN se trouvaient étiquetés " types ", l'un de ces deux exemplaires a dû être ajouté par Jousseaume postérieurement à la description, et n'a donc aucun statut de type. C'est cet exemplaire qui est figuré par erreur par FAIR (1976, pl. 23, fig. 363) comme type de *M. flavidus*.

J. flavidus est caractérisé par une coquille anguleuse, avec des côtes spirales prononcées et une sculpture squameuse. Elle ressemble à *J. decussatus* par sa spire assez basse, mais diffère par d'autres points (voir sous *J. decussatus*).

La couleur de la coquille est d'un brun uniforme, souvent ponctué de taches d'un brun-rougeâtre, elle atteint la taille de 40 mm.

***

JOUSSEAUME (1874) described (as *Murex flavidus*) and illustrated (as *M. rusticus*) a single shell. Nevertheless, two specimens in MNHN are labeled as "types," one of which was probably added by Jousseaume after the description had been published. This second specimen, which is not to be considered a type, was erroneously figured by Fair (1976, Plate 23, Fig. 362) as the type of *M. flavidus*.

Jaton flavidus is characterized by a shouldered shell with strong spiral cords, a denticulate outer lip, squamose texture, and spinose varices. It resembles *J. decussatus* in having a low spire, but differs in many aspects (see under *J. decussatus*). The shell of *J. flavidus* is uniformly brown, often with reddish-brown spots, up to 40 mm in length. The species is known only from near Dakar, Senegal, where it occupies slightly deeper habitats than *J. decussatus*.

Genre *Chicocenebra* Bouchet & Houart, 1996

Espèce-type: *Murex gubbi* Reeve, 1849, par désignation originale.

Murex gubbi Reeve, 1849, espèce classée parmi les *Chicoreus* (sous famille des Muricinae) à cause de la ressemblance de la coquille avec les espèces de ce genre, a été élevé au rang d'espèce type pour le genre *Chicocenebra* (Ocenebrinae) (BOUCHET & HOUART, 1996). L'étude de la radula a en effet prouvé la parenté de cette espèce avec les espèces incluses dans les Ocenebrinae.

Chicocenebra diffère des autres genres dont la coquille possède trois varices sur le dernier tour de spire, *Jaton* Pusch, 1837, *Ceratostoma* Hermanssen, 1846, *Poropteron* Jousseaume, 1880, *Pteropurpura* Jousseaume, 1880, *Calcitrapessa* Berry, 1959, et *Microrhytis* Emerson, 1959, par son ouverture denticulée, son épine carinale cannelée, son canal siphonal ouvert et ses épines foliacées. Elle diffère également de *Ceratostoma* et de *Microrhytis* par l'absence de denticule labial.

***

The tropical West African *Murex gubbi* Reeve, 1849, until now classified in *Chicoreus* (subfamily Muricinae), was made the type of the new genus *Chicocenebra* (subfamily Ocenebrinae), based on radular morphology (BOUCHET & HOUART, 1996). The species has been erroneously classified due to the convergence of its shell with those of *Chicoreus*.

Chicocenebra differs from the other trivaricate ocenebrine taxa *Jaton* Pusch, 1837, *Ceratostoma* Hermanssen, 1846, *Poropteron* Jousseaume, 1880, *Pteropurpura* Jousseaume, 1880, *Calcitrapessa* Berry, 1959, and *Microrhytis* Emerson, 1959 in the peculiar denticulate aperture, the channeled shoulder spine, the open siphonal canal and the numerous, frondose varical spines. From *Ceratostoma* and *Microrhytis*, it differs also by the absence of labral tooth.

Chicocenebra gubbi (Reeve, 1849)
Figs 172-173, 181, 254

Murex gubbi Reeve, 1849: pl. 1, fig. 193

Matériel type: Non localisé (ni au BMNH ni au NMW).

Localité type: Non précisée.

Distribution: L'espèce est connue au Ghana, où elle est peu commune jusqu'à 50 m (Ryall, comm. pers.), au Gabon, où elle n'est pas rare dans les eaux peu profondes des estuaires (Libreville, Cap esterias) et jusqu'en Angola (Cucuaco). Une coquille vide fut récoltée dans l'Archipel des Bissagos (Guinée-Bissau) (DELEMARRE, 1995).

Remarques: *Chicocenebra gubbi* est facilement identifiable par la présence de ses 3 varices par tour, par sa haute spire et son canal siphonal comparativement assez court, par son épine carinale cannelée et par la lèvre externe de l'ouverture, fortement denticulée intérieurement. La forme de la coquille de *C. gubbi* est assez similaire à celle de *Ocenebra isaacsi*, néanmoins elle en diffère par la

taille très différente et la morphologie différente de l'ouverture, des épines et de la protoconque.

La coquille est brun foncé uniforme et atteint une taille variant entre 37 et 60 mm.

***

Chicocenebra gubbi is easily distinguishable by its trivarical whorls, its high spire and relatively short siphonal canal, its long, channeled shoulder spine, and the strongly denticulate outer apertural lip. *C. gubbi* is similar in shape to *Ocenebra isaacsi*. However, the two species have a very different size, and different morphology of aperture, varical spines and protoconch.

Uniformly dark brown, up to 60 mm in length.

ESPECES MEDITERRANEENNES (MEDITERRANEAN SPECIES)

Trois espèces d'Ocenebrinae à prédominance méditerranéenne et/ou européenne sont présentes dans la région étudiée: *Ocenebra (Ocinebrina) edwardsi* (Payraudeau, 1826) atteint le Sahara Occidental, et *O. (Ocinebrina) aciculata* (Lamarck, 1822) atteint le Sénégal, tandis que *O. (O.) miscowichae* (Pallary, 1920), décrite du Maroc, est présente juqu'au Sud du Sahara Occidental. Cette dernière espèce ayant été dédiée à Melle Lucie Miscowich, il convient dès lors d'adopter l'appellation *O. miscowichae* et non plus *miscowichi* utilisé par Pallary [ICZN, art. 31a (ii)].

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There are three Mediterranean and/or Mediterranean species of Ocenebrinae occuring in the northern limit of the studied area: *Ocenebra (Ocinebrina) edwardsi* (Payraudeau, 1826) which attains Western Sahara, and *O. (Ocinebrina) aciculata* (Lamarck, 1822) present in Senegal. *O. (O.) miscowichae* (Pallary, 1920), described from Morocco, occurs also in the south of Western Sahara. That species, described as *Ocinebrina miscowichi*, was dedicated to Miss Lucie Miscowich. The name must thus be emended as *miscowichae* [ICZN, art. 31a (ii)].

IV. ERGALATAXINAE Kuroda & Habe, 1971

Les Ergalataxinae sont représentés par trois espèces en Afrique Occidentale, mais aucune n'y est endémique. *Cytharomorula grayi* (Dall, 1889) et *Trachypollia turricula* (von Maltzan, 1884) étant également présents dans l'Atlantique Occidental (Floride, Antilles, Brésil). *C. grayi* est une espèce probablement cosmopolite, des spécimens très similaires ont en effet été signalés en Polynésie Française (TRÖNDLÉ & HOUART, 1992: 88) et en Nouvelle-Calédonie (HOUART, 1995: 254), tandis que d'autres exemplaires ont été récoltés dans l'Océan Indian (MNHN et NM). *T. turricula* est connue sous le nom de *T. didyma* (Schwengel, 1943) dans l'Atlantique Occidental. *T. didyma* diffère de la forme typique par sa coquille plus globuleuse.

La troisième espèce d'Afrique Occidentale, *Orania fusulus* (Brocchi, 1814), présente jusqu'en Angola, est une espèce d'origine méditerranéenne.

Les trois espèces possèdent une protoconque multispirale.

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There are three species of Ergalataxinae living off West Africa, but none of them is endemic to the West African coast, *Cytharomorula grayi* (Dall, 1889) and *Trachypollia turricula* (von Maltzan, 1884) occuring also in the Western Atlantic (Florida, Antilles, Brazil). *C. grayi* is probably a world-wide species, very similar specimens have been reported in French Polynesia (TRÖNDLÉ & HOUART, 1992: 88), and in New Caledonia (HOUART, 1995: 254), while other specimens have been collected in the Indian Ocean (MNHN and NM). A more globose form of *T. turricula* is known as *T. didyma* (Schwengel, 1943) in the Western Atlantic.

The third West African species, which occurs up to Angola, *Orania fusulus* (Brocchi, 1814), is also known in the Mediterranean.

The three species have a shell with multispiral protoconch.

Genre *Cytharomorula* Kuroda, 1953

Espèce-type: *Cytharomorula vexillum* Kuroda, 1953, par désignation originale.

Cytharomorula grayi (Dall, 1889)
Figs 191, 222-223

Nassaria (Nassarina) grayi Dall, 1889: 183, pl. 32, fig. 12a

Cantharus (Tritonidea) laevis Smith, 1891: 261, pl. 21, fig. 11

Trophon lowei Watson, 1897: 244, pl. 19, fig. 12

Matériel type examiné: *N. grayi*: lectotype MCZ 7256, designé par VOKES (1996: 29); *C. laevis*: 5 syntypes BMNH 89.10.1.2363; *T. lowei*: holotype BMNH 1911.7.17.2.

Localités types: *N. grayi*: Barbades, 133,5 m, désigné par VOKES (1996: 29); *C laevis*: Ste Hélène; *T. lowei*: Madère.

Distribution: Iles Canaries et Sainte Hélène, jusqu'à 200 m. de profondeur.

Remarques: Cette espèce est classée dans le genre *Evokesia* par RADWIN & D'ATTILIO (1976: 143). BOUCHET & WARÉN (1985: 149) mentionne le genre *Cytharomorula* comme possible pour cette espèce, mais ils la classent néanmoins parmi les *Orania*, un autre genre compris dans les Ergalataxinae.

La morphologie de la coquille de *C. grayi* est identique à l'espèce type de *Cytharomorula*, raison pour laquelle je classe cette espèce dans ce genre bien précis.

C. grayi est peu variable, de couleur ocre, avec des cordons spiraux brun-rougeâtres et une bande spirale brune située sous la carène, l'ouverture est blanche. La coquille atteint la taille de 20 mm.

***

Cytharomorula grayi was included in *Evokesia* by RADWIN & D'ATTILIO (1976: 143). BOUCHET & WARÉN (1985: 149) mention *Cytharomorula* as an eventual genus for that species, however, they include it in *Orania*, another ergalataxine genus.

The similarity of shell morphology of *C. grayi* with *C. vexillum*, the type species of *Cytharomorula*, is the reason of its current classification in that genus.

The shell is ochre with reddish-brown spiral cords, and a brown spiral band just below the shoulder. Aperture white. Up to 20 mm in length.

Genre *Trachypollia* Woodring, 1928

Espèce-type: *Trachypollia sclera Woodring, 1928*, par désignation originale.

Trachypollia turricula (von Maltzan, 1884)
Figs 178, 192, 224-225

Cantharus (Pollia) turricula von Maltzan, 1884: 67
Cantharus (Pollia) subsinuatus von Maltzan, 1884: 67
Drupa didyma Schwengel, 1943: 76, pl. 7, fig. 7

Matériel type examiné: *C. turricula*: holotype ZMB 37205; *C. subsinuatus*: holotype ZMB 37206; *D. didyma*: lectotype ANSP 178763, désigné par VOKES (1996: 38).

Localités types: *C. turricula* et *C. subsinuatus*: Gorée, Sénégal; *D. didyma*: Palm Beach, Floride, 61 m.

Distribution: Depuis l'Archipel du Cap Vert jusqu'à Luanda (Angola); sur ou sous les rochers, juqu'à 40 m. de profondeur.

Remarques: *Trachypollia turricula* est très souvent confondue avec *Muricopsis (Risomurex) suga suga* (Fischer-Piette, 1942). Elle s'en distingue notamment par sa protoconque conique et multispirale (Fig. 192), alors que la coquille de *M. suga suga* présente une protoconque paucispirale et carénée (HOUART, 1996: fig. 103). *M. suga suga* est blanchâtre avec des rangées axiales aux tubercules bruns foncés et une ouverture blanche, tandis que *T. turricula* est de couleur brun clair à brun foncé uniforme, avec quelquefois des nodosités plus claires à l'intersection des côtes axiales et des cordons spiraux. L'ouverture est brune. Elle atteint la taille de 13 mm. VOKES (1996) sépare *T. turricula* et *T. didyma* sur base de dimensions différentes. La coquille de *T. didyma* étant plus globuleuse.

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Trachypollia turricula is often confused with *Muricopsis (Risomurex) suga suga* (Fischer-Piette, 1942), however, both species are easily separable. *M. suga suga* has a paucispiral, keeled protoconch (HOUART, 1996: fig. 103), whereas *T. turricula* has a shell with conical, multispiral protoconch (Fig. 192). *M. suga suga* is whitish with tops of each axial rib marked with dark reddish-brown. The aperture is white. *T. turricula* is uniformly light or dark brown, occasionally with lighter coloured nodes at the intersection of axial ribs and spiral cords. Shell up to 13 mm in length. VOKES (1996) separates *T. turricula* from *T. didyma* on basis of a more globose shell in *T. didyma*.

ESPECE MEDITERRANEENNE (MEDITERRANEAN SPECIES)

Une seule espèce de Méditerranée, *Orania fusulus* (Brocchi, 1814), est présente en Afrique Occidentale. Sa distribution s'étend jusqu'en Angola où elle est connue sous le nom de *Murex angolensis* Odhner, 1922, un synonyme (Figs 226-228).

***

Only one mediterranean species of Ergalataxinae, *Orania fusulus* (Brocchi, 1814), occurs off West Africa, up to Angola, where is it known as *Murex angolensis* Odhner, 1922, a synonym (Figs 226-228).

V. TRIPTEROTYPHINAE D'Attilio & Hertz, 1989

Une espèce récemment décrite est présente en Afrique Occidentale. Sa répartition géographique est limitée au Ghana.

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Only one, recently described species is known from West Africa. Its geographical distribution is limited to Ghana.

Genre *Pterotyphis* Jousseaume, 1880

Espèce-type: *Typhis pinnatus* Broderip, 1833, par désignation originale

Pterotyphis ryalli Houart, 1996
Figs 229-230

Pterotyphis pinnatus -D'ATTILIO & HERTZ, 1989: 105, figs 1 & 2 [not *P. pinnatus* (Broderip, 1833)].

Pterotyphis ryalli Houart, 1996a: 62, figs 18-20.

Matériel type examiné: Holotype IRSNB 28292/473.

Localité type: Ile de Busua, Ghana

Distribution: Afrique Occidentale, Ghana, Busua et Takoradi.

Remarques: *Pterotyphis pinnatus* (Broderip, 1833) de l'Atlantique Occidental est superficiellement similaire. La coquille diffère en étant comparativement plus grande, plus fortement carénée et plus large, avec des cordons spiraux plus nombreux et plus étroits. Les varices sont plus minces et plus fortement frangée.

La seule autre espèce de *Pterotyphis*, *P. fimbriatus* (A. Adams, 1854) vit dans le Pacifique Oriental, dans le Golfe de Californie et au Mexique.

***

Pterotyphis pinnatus (Broderip, 1833) from the Western Atlantic is superficially similar, but differs in having a relatively larger, more strongly shouldered and broader shell, with narrower, more numerous spiral cords and threads, and thinner, more strongly fimbriate varical wings.

The only other known Recent species of *Pterotyphis* is *P. fimbriatus* (A. Adams, 1854) from the Gulf of California and Mexico, Eastern Pacific.

VI. TYPHINAE Cossman, 1903

La sous-famille des Typhinae est représentée en Afrique Occidentale par trois espèces, dont *Typhis (Typhinellus) fistulatus* (Risso, 1826) (= *Typhis sowerbyi* Broderip, 1833), à distribution géographique presqu'exclusivement méditerranéenne. Les deux autres espèces vivent également dans l'Atlantique Occidental.

***

The Typhinae are represented by three species in West Africa, of which *Typhis (Typhinellus) fistulatus* (Risso, 1826) (= *Typhis sowerbyi* Broderip, 1833), almost exclusively Mediterranean. The two other species also live in the Western Atlantic.

Genre *Typhis* Montfort, 1810

Sous-genre: *Typhina* Jousseaume, 1880

Espèce-type: *Typhis belcheri* Broderip, 1833, par désignation originale

Typhis (Typhina) belcheri Broderip, 1833
Figs 194, 231-232, 233

Typhis belcheri Broderip, 1833: 178

Murex (Typhis) cleryi Petit de la Saussaye, 1840: 327

Matériel type examiné: *T. belcheri*: 3 syntypes BMNH 197469; *M. cleryi*: holotype MNHN.

Localité type: *T. belcheri*: "ad Africam Occidentalem (Cape Blanco)" (= Cap Blanc, Mauritanie, vers 20°50' N); *M. cleryi*: Brésil.

Distribution: Archipel du Cap Vert, Sahara Occidental et Sénégal, de 13 à 85 m. de profondeur.

Remarques: Un syntype de *Typhis belcheri* a été illustré par KAICHER (1980: carte 2514). J'ai examiné les types des deux noms et comparé de nombreux exemplaires du Brésil et d'Afrique Occidentale: les protoconques et les téléoconques des deux ensembles de populations sont identiques et indiscernables. Je conclus donc à leur conspécificité, bien que l'absence de larves planctoniques indiquée par la protoconque (Fig. 194) implique probablement une absence d'échanges entre l'Atlantique oriental et l'Atlantique occidental.

La coquille est blanchâtre ou brunâtre, et l'extrémité des épines et des tubes est quelquefois légèrement teintée de brun. Elle mesure de 15 à 26 mm.

***

One of the three syntypes of *Typhis belcheri* was illustrated by KAICHER (1980: card 2514). I compared the type material of both taxa, and numerous specimens from both sides of the Atlantic. The protoconch and teleoconch characters are similar in both populations. As a conclusion, I consider both forms as conspecific, although the non-planktotrophic larval development, suggested by a paucispiral protoconch (Fig. 194), probably implies a lack of exchange between eastern and western Atlantic.

The shell is whitish or brownish, with the extremity of spines and tubes occasionally brown coloured. Up to 26 mm in length.

Sous-genre *Talityphis* Jousseaume, 1880

Espèce-type: *Typhis expansus* Sowerby, 1874, par désignation originale.

Typhis (Talityphis) expansus Sowerby, 1874
Figs 234-235

Typhis expansus Sowerby, 1874: 719, pl. 59, fig. 4.

Talityphis perchardei Radwin & D'Attilio, 1976: 236, text figs 190-192, pl. 30, fig. 15.

Matériel type: *T. expansus*: holotype NMW 1955.158.19; *T. perchardei*: SDSNH 63079.

Localités types: *T. expansus*: Paramaribo, Surinam (désigné par GERTMAN, 1969: 167); *T. perchardei*: Bocas, Trinitad, West Indies.

Distribution: Près de l'Ile Banié, Gabon.

Remarques: Une comparaison minutieuse des exemplaires trouvés en Afrique Occidentale avec des spécimens provenant du Panama et de Martinique m'a permis de conclure à la conspécificité de ce matériel. Les spécimens adultes du Gabon sont plus étroits et possèdent des varices légèrement plus arrondies, mais les coquilles juvéniles du Gabon et des Antilles sont inséparables. Les différences sont minimes et ne sont probablement qu'intraspécifiques.

Typhis (Rugotyphis) puertoricensis Warmke, 1964, des Caraïbes possède une coquille plus globuleuse et comparativement plus petite, avec des taches brunâtres sur le bord externe de l'ouverture et sur le canal siphonal.

L'holotype de *T. expansus* est illustré par VOKES (1989: 78, text fig. 21).

***

Typhis expansus is another species with Eastern and Western Atlantic representatives. Comparison of material from West Africa, Martinique and Panama leaves no doubt about conspecificity of both populations. Adult specimens from Gabon are narrower and have slightly more rounded varices. Juvenile shells from Gabon and from the West Indies are totally similar. The holotype of *T. expansus* was illustrated by VOKES (1989: 78, text fig. 21).

Typhis (Rugotyphis) puertoricensis Warmke, 1864 from the Caribbean is more globose and relatively smaller, with brown blotches on the outer apertural edge, and on the siphonal canal.

ESPECE MEDITERRANEENNE (MEDITERRANEAN SPECIES)

La Méditerranée ne connait qu'une seule espèce de Typhinae, *Typhis (Typhinellus) fistulatus* (Risso, 1826) (= *Typhis sowerbyi* Broderip, 1833). Elle est également signalée aux Iles Canaries (NORDSIECK & GARCIA TALAVERA, 1979: 131) et au large de Dakar (MARCHE-MARCHAD, 1958: 25).

***

The Mediterranean *Typhis (Typhinellus) fistulatus* (Risso, 1826) (= *Typhis sowerbyi* Broderip, 1833), occurs also in the Canary Islands (NORDSIECK & GARCIA TALAVERA, 1979: 131) and off Dakar (MARCHE-MARCHAD, 1958: 25).

VII. TROPHONINAE Cossmann, 1903

Dans un article récent, KOOL (1993) démontre que *Trophon geversianus* (Pallas, 1774), espèce type des Trophoninae est plus proche des genres *Nucella* et *Ocenebra*. Trophoninae deviendrait dès lors synonyme de Ocenebrinae et la plupart des espèces incluses jusqu'à présent dans les Trophoninae, dont les espèces d'Afrique Occidentale devraient être groupées dans une autre sous-famille. Pour l'instant nous conservons néanmoins la classification traditionnelle.

Il existe trois espèces de Trophoninae en Afrique Occidentale: *Boreotrophon fraseri* (Knudsen, 1956), *Trophonopsis guineensis* (Thiele, 1925) et une espèce du Nord Est de l'Atlantique, *Trophonopsis cossmanni* (Locard, 1897).

***

Trophoninae is here used in the traditional way, to include typical "*Trophon*-like" species. However, in a recent paper, KOOL (1993), demonstrated that *Trophon geversianus* (Pallas, 1774), the type species of Trophoninae, is closely related to *Nucella* and *Ocenebra*. A new name for many of its members, including the West African species, might be warranted.

Three trophonine species occur off West Africa: *Boreotrophon fraseri* (Knudsen, 1956), *Trophonopsis guineensis* (Thiele, 1925), and a Northeast Atlantic species, *Trophonopsis cossmanni* (Locard, 1897).

Genre *Boreotrophon* Fischer, 1884

Espèce-type: *Murex clathratus* Linnaeus, 1767, par monotypie.

Boreotrophon fraseri (Knudsen, 1956)
Figs 179, 236-237

Trophon fraseri Knudsen, 1956: 19, pl. 1, fig. 2.

Matériel type examiné: Holotype ZMC.

Localité type: Guinée Equatoriale, 2°09' N, 9°27' E, 260-650 m.

Distribution: Depuis la Mauritanie (18° 30' N, 16°43'E) jusqu'au nord de l'Angola (7°55' S, 12°38' E), par 235 à 650 m. de profondeur.

Remarques: HOUART & AZNAR (1982) ont signalés cette espèce, vivante, en Méditerranée (Palma de Mallorca et Menorca, entre 15 et 20 mètres de profondeur).

La coquille peut se présenter soit sous la forme typique, avec des lamelles axiales se prolongeant en épines ouvertes sur la carène des deux derniers tours de téléoconque (Fig. 236), soit en présentant des varices arrondies, sans épines carinales (Fig. 237).

Blanc sale, ocre ou brun clair, elle atteint la taille de 50 mm.

***

HOUART & AZNAR (1982) mentioned that species, living in the Mediterranean (Palma de Mallorca and Menorca, from 15 to 20 m depth).

The shell has rounded varices (Fig. 237) or typical axial lamellae, ending as open, adapically bent, spines at shoulder (Fig. 236).

Dirty white, ochre or pale brown, up to 50 mm in length.

Genre *Trophonopsis* Bucquoy & Dautzenberg, 1882

Espèce-type: *Murex muricatus* Montagu, 1803, par désignation originale.

Trophonopsis guineensis (Thiele, 1925)
Fig. 238

Trophon guineensis Thiele, 1925: 135, pl. 18, fig. 11.

Matériel type examiné: holotype ZMB.

Localité type: Golfe de Guinée, 3°10' N, 5°28.5' E, 2278 m.

Distribution: Golfe de Guinée et Angola (10°30' S, 11°55' E) (BOUCHET & WARÉN, 1985: 139).

Remarques: La coquille de *Trophonopsis guineensis* est similaire à celle de *T. cossmanni* (Locard, 1897), mais l'animal diffère de cette espèce par ses yeux non pigmentés, *T. cossmanni* ayant les yeux noirs, tandis que la ponte révèle des oeufs de petite taille, indiquant un développement larvaire planctonique (BOUCHET & WARÉN, 1985: 139). La coquille est blanche et atteint 12,6 mm (holotype).

***

Trophonopsis guineensis is similar to *T. cossmanni* (Locard, 1897) from the Northeast Atlantic. However, the animal of *T. guineensis* differs in having unpigmented eyes, *T. cossmanni* having black eyes, while the small diameter of the eggs indicates planktonic larval development (BOUCHET & WARÉN, 1985: 139). Shell white, up to 12.6 mm in length (holotype).

ESPECE DU NORD-EST ATLANTIQUE (NORTHEAST ATLANTIC SPECIES)

Trophonopsis cossmanni (Locard, 1897) a été signalé à l'Ouest du Sénégal (LOCARD, 1897: 343), par 1617 m. de profondeur. L'espèce est illustrée ici (Fig. 239) pour comparaison avec *Trophonopsis guineensis* (Thiele, 1925). *T. cossmanni* est considéré comme synonyme de *T. echinatus* (Kiener, 1840) par BOUCHET & WARÉN (1985: 137).

***

Trophonopsis cossmanni (Locard, 1897) was mentioned from off Dakar by LOCARD (1897: 343), in 1617 m. depth. The shell is here illustrated (Fig. 239) for comparison with *Trophonopsis guineensis* (Thiele, 1925). *T. cossmanni* is regarded as a synonym of *T. echinatus* (Kiener, 1840) by BOUCHET & WARÉN (1985: 137).

VIII. RAPANINAE Gray, 1853

Les Rapaninae, représentés par sept espèces en Afrique Occidentale, ont une très large distribution géographique, due probablement à leur vie larvaire planctonique. Leur habitat se situe dans les eaux littorales et sublittorales, principalement sur les rochers.

Une espèce de l'Atlantique Occidental, *Purpura patula* (Linnaeus, 1758) fut signalée au Sénégal par ADANSON (1757) qui la décrivit sous le nom de " Le Pakel ". La coquille originale fut retrouvée et illustrée par FISHER-PIETTE (1942: pl. 5, fig. 3). *Purpura eudeli* Sowerby, 1903 est la même espèce décrite de Gorée. Cette espèce n'a pourtant plus été retrouvée depuis sa description et sa présence en Afrique Occidentale est très douteuse.

Stramonita haemastoma (Linnaeus, 1767), à répartition géographique méditerranéenne et amphi atlantique est présente et commune tout le long de la côte Ouest-africaine.

***

There are seven littoral or sublittoral species of Rapaninae in West Africa, all have a large geographical range, probably due to a planktonic larval life. They live usually on rocks. *Purpura patula* (Linnaeus, 1758), a West Atlantic species, was reported in Senegal by ADANSON (1757) who named it "Le Pakel". The original shell was illustrated by FISCHER-PIETTE (1942: pl. 5, fig. 3). *Purpura eudeli* Sowerby, 1903 is the same species, described from Goree (Senegal). The species was never more recorded since its description, and its presence in West Africa is very doubtful.

Stramonita haemastoma (Linnaeus, 1767), a Mediterranean species, also lives in the West and East Atlantic. The species is common along the West African coast.

Genre *Thais* Röding, 1798

Sous-genre: *Thais* Röding, 1798

Espèce-type: *Thais lena* Röding, 1798 (= *Nerita nodosa* Linnaeus, 1758), par désignation subséquente (Stewart, 1926).

Thais (Thais) nodosa (Linnaeus, 1758)
Fig. 240

Nerita nodosa Linnaeus, 1758: 777
Murex neritoides Linnaeus, 1758: 1219
Thais lena Röding, 1798: 54
Thais meretricula Röding, 1798: 54
Purpura ascensionis Quoy & Gaimard, 1833: 559, pl. 37, figs 20-23.

Matériel type examiné: *Purpura ascensionis*: holotype MNHN.

Localités types: *P. ascensionis*: Ascension, les autres noms sont décrits de localité inconnue.

Distribution: Depuis l'Archipel du Cap Vert jusqu'en Angola.

Remarques: La coquille est solide, garnie de 3 à 4 cordons spiraux, ornés de courtes épines émoussées, plus grandes et plus solides sur les deux rangées adapicales. L'ouverture est blanche et le bord columellaire est garni de 1 à 4, généralement 2, pustules noirs.

La protoconque, très souvent couverte de concrétion calcaire, n'a pu être observée à ce jour.

La taille varie de 30 à 52,5 mm.

***

The shell is solid, with 3 or 4 spiral cords, bearing short, blunt spines, larger and stronger on the two adapical spiral rows. Aperture white, columellar lip with 1-4, usually 2, black pustules.

Protoconch unknown. Size from 30 to 52.5 mm in length.

Sous-genre: *Thaisella* Clench, 1947

Espèce-type: *Purpura trinitatensis* Guppy, 1869 (= *Purpura coronata* Lamarck, 1816), par désignation originale.

Thais (Thaisella) callifera (Lamarck, 1822)
Figs 177, 241-242, 251-252

Purpura callifera Lamarck, 1822: 240

Matériel type examiné: 2 syntypes MHNG 1101/50/1-2.

Localité type: inconnue.

Distribution: Depuis la Mauritanie jusqu'au Zaïre.

Remarques: La coquille est solide et globuleuse, avec une spire très basse. Le dernier tour de téléoconque occupe de 85 à 92% de la longueur totale d'une coquille adulte. Il est orné de 4 cordons spiraux noduleux, dont l'adapicale forme un bourrelet recouvrant la suture des tours et une partie du tour précédent.

La coquille est blanchâtre, l'ouverture et le bord columellaire sont orange clair.

La protoconque n'a pas pu être observée pour cause d'érosion ou de concrétion calcaire. La taille varie de 25 à 45 mm.

***

The shell is solid and globose, with a very low spire. The last teleoconch whorl takes up 85 to 92 % of the total shell length. It bears 4 nodose spiral cords; adapical cord strong, broad, and rounded, covering the suture and part of the preceding whorl.

Shell whitish, the aperture and the columellar lip are pale orange.

The protoconch is eroded, or covered by a calcareous layer in all examined specimens. The length varies from 25 to 45 mm.

Thais (Thaisella) coronata (Lamarck, 1816)
Figs 176, 195, 243-244, 249-250

Purpura coronata Lamarck, 1816: pl. 397, fig. 4
Purpura guinensis Schubert & Wagner, 1829: 144, pl. 232, figs 4083-4084
Thais trinitatensis Guppy, 1869: 366
Thais coronata brujensis M. Smith, 1946: 61

Matériel type examiné: *P. coronata*: 3 syntypes probables MHNG 1101/51/1-3; *P. trinitatensis*: neotype MCZ n° 177755, désigné par CLENCH (1947: 70).

Localités types: *P. coronata*: Sénégal (LAMARCK, 1822: 241); *P. guinensis*: Guinée; *P. trinitatensis*: Gulf of Paria, Trinitad; *T. coronata brujensis*: Bruja Point, Canal zone, Caraïbes.

Distribution: Depuis le Sud de la Mauritanie jusqu'en Angola. Elle est également trouvée au Nord-Est du Brésil (RIOS, 1970: 83; 1985: 91). Je n'ai personnellement pas connaissance de cette espèce dans les Iles du Cap Vert, signalée là par CLENCH & TURNER (1948: 3) et par RIOS (1970: 83; 1985: 91).

Remarques: Coquille solide et blanchâtre avec des taches plus sombres sur les cordons spiraux. L'ouverture et le bord columellaire sont orange clair.

Thais coronata diffère de *T. callifera*, espèce similaire, en possèdant une spire plus haute, le dernier tour de téléoconque occupant 77 à 84% de la longueur totale d'une coquille adulte. Le bourrelet subsutural est plus atténué et les lamelles suturales sont bien séparées et non soudées comme chez *T. callifera*, où elle forme une grosse côte spirale. Les épines sont plus apparentes et moins émoussées, l'ouverture est plus large et l'espace situé entre le cordon spiral abapical du dernier tour et le cordon spiral adapertural du canal siphonal est plus grand.

***

Shell solid, whitish, with dark blotches on the spiral cords. The aperture and the columellar lip are pale orange.

Thais coronata differs from *T. callifera* in having a higher spire with a last teleoconch whorl taking up 77 to 84 % of the total shell length. The adapical spiral cord is weaker and the sutural lamellae are separated, not sealed like in *T. callifera*. The spines are more apparent. The aperture is broader, and the space between the abapical spiral cord of the last whorl, and the adapertural spiral cord of the siphonal canal is larger.

Thais (Thaisella) langi Clench & Turner, 1948
Figs 245-246

Thais (Thaisella) langi Clench & Turner, 1948: 1, figs 7-9

Matériel type: Holotype AMNH 72715.

Localité type: Lobito Bay, Angola.

Distribution: du Sénégal jusqu'en Angola.

Remarques: Cette espèce est parfois erronément illustrée sous le nom de *Thais forbesi* (Dunker, 1853) (NICKLES, 1950: 93; GOFAS *et al.*, 1985: 72). *Thais forbesi* (Fig. 247) représente une forme de *Stramonita haemastoma* (Linnaeus, 1767), une espèce polymorphe, amphiatlantique, commune en Méditerranée et en Afrique Occidentale.

La coquille est trapue et solide, garnie habituellement de 2 rangées de tubercules plus ou moins prononcés et de 3 à 5 cordons spiraux plus

atténuées. L'ouverture est large et le canal siphonal court.

Grisâtre, la coquille présente quelquefois des taches brunes sur les cordons spiraux, l'ouverture est blanc-bleuté. La taille varie de 30 à 45 mm.

***

Thais langi is occasionally illustrated as *Thais forbesi* (Dunker, 1853) (NICKLES, 1950: 93; GOFAS *et al.*, 1985: 72). *Thais forbesi* (Fig. 247) is a form of *Stramonita haemastoma* (Linnaeus, 1767), a polymorphic and amphiatlantic species, common in the Mediterranean and along the West African coast.

The shell is solid, usually with 2 rows of more or less strong nodes, and 3 to 5 attenuated spiral cords. The aperture is large, and the siphonal canal short.

Greyish, occasionally with some brown blotches on the spiral cords. The aperture is bluish-white. Shell from 30 to 45 mm in length.

Genre *Morula* Schumacher, 1817

Espèce-type: *Morula papillosa* Schumacher, 1817 (= *Drupa uva* Röding, 1798)

Morula nodulosa (C.B. Adams, 1845)
Figs 174-175, 197, 257-260

Purpura nodulosa C.B. Adams, 1845: 2

Ricinula ferruginosa Reeve, 1846: sp. 50

Matériel type examiné: *P. nodulosa*: Lectotype MCZ 177045; *R. ferruginosa*: 3 syntypes BMNH 1968462.

Localité type: *P. nodulosa*: Jamaique; *R. ferruginosa*: inconnue.

Distribution: Espèce amphiatlantique, vivant dans l'Atlantique oriental depuis l'Archipel du Cap Vert jusqu'en Angola (Bengo).

Remarques: Le classement de cette espèce a été assez erratique, traitée comme *Drupa* (NICKLES, 1950), *Morula* (BERNARD, 1984, RIOS, 1985) ou *Trachypollia* (RADWIN & D'ATTILIO, 1976), elle est classée ici parmi les *Morula* pour la similitude des caractères morphologiques de la coquille et de la radula avec l'espèce type du genre *Morula* et d'autres espèces du genre.

La forme générale de la coquille est variable, la sculpture est formée de nodules résultant du croisement des cordons spiraux et des côtes axiales. Occasionnellement, une, voire deux, de ces côtes axiales est épaissie et forme une varice.

Coquille brune à noire, nodules généralement plus foncés, les côtes axiales sont parfois tachées de blanc. Ouverture gris bleuâtre.

En Afrique Occidentale, la taille adulte varie de 13 à 22 mm.

La protoconque (Fig. 197) est multispirale et indique un développement larvaire planctotrophe.

***

Morula nodulosa was classified in *Drupa* (NICKLES, 1950), *Morula* (BERNARD, 1984, RIOS, 1985) or *Trachypollia* (RADWIN & D'ATTILIO, 1976). It is here included in *Morula* for similarity of the shell and radula characters with the type species of *Morula* and other species of the genus. The species is amphiatlantic.

The shell morphology is quite variable. The sculpture consists of axial ribs and spiral cords, giving rise to nodes at their intersection. One, or occasionally two, of the axial ribs are occasionally thickened to form erratically placed varices.

Shell brown or black, usually with darker coloured nodes. The axial ribs are occasionally spotted with white. Aperture bluish-grey. Its length varies from 13 to 22 mm. The protoconch (Fig. 197) is multispiral, attesting of a planktotrophic larval development.

ESPECE MEDITERRANEENNE (MEDITERRANEAN SPECIES)

Stramonita haemastoma (Linnaeus, 1767) (Figs 247-248) est une espèce à larve planctonique connaissant une très large distribution géographique. En Afrique l'espèce est présente tout le long de la côte occidentale, jusqu'en Namibie. *Purpura forbesi* Dunker, 1853 est une forme décrite de Luanda, Angola (voir sous *Thais langi* Clench & Turner, 1948).

***

Stramonita haemastoma (Linnaeus, 1767) (Figs 247-248) is a species with planktotrophic larval development, with a wide geographical range. The species is common along the West African coast, up to Namibia. *Purpura forbesi* Dunker, 1853 is a form described from Luanda, Angola (see under *Thais langi* Clench & Turner, 1948).

IX. ESPECES DE L'ILE DE SAINTE HELENE (SPECIES OF THE ISLAND OF SAINT HELENA)

L'Ile de Sainte Hélène est située dans l'Atlantique Est, à 15°58' S, 5°43'W, à 1850 kms de la côte africaine et à 3500 kms du Brésil. Les mollusques marins furent étudiés par SMITH (1891) qui décrivit deux nouvelles espèces de Muricidae.

Les espèces sont mentionnées dans la présente étude parce qu'un petit pourcentage de mollusques marins de l'Ile de Sainte Hélène se retrouve au large des côtes Ouest africaines (SMITH, 1891: 248).

***

The Island of Saint Helena is situated in the East Atlantic, at 15°58' S, 5°43' W, at 1850 kms from the African coast and 3500 kms from Brazil. The marine molluscs were studied by SMITH (1891) who described two new species of Muricidae.

The species from Saint Helena are included here, because a small percentage of marine molluscs from Saint Helena also occurs off West Africa (SMITH, 1891: 248).

OCENEBRINAE Cossmann, 1903

Pteropurpura sanctaehelenae (Smith, 1891)
Figs 214-215

Murex (Ocinebra) sanctaehelenae Smith, 1891: 258, pl. 23, fig. 5

Matériel type examiné: holotype BMNH 1889.10.1.2387.

Localité type: Sainte Hélène.

Distribution: L'espèce est uniquement connue de la localité type, Sainte Hélène.

Remarques: Le classement de cette espèce, connue uniquement par l'holotype, est douteux: *Murex sanctaehelenae* a été classé dans le genre *Murexiella* (Muricopsinae) par VOKES (1971a: 74) et FAIR (1976: 75), et dans *Poropteron* (Ocenebrinae) par RADWIN & D'ATTILIO (1976: 128). L'un et l'autre de ces genres ne me paraissent pas appropriés: *M. sanctaehelenae* possède 3 varices axiales par tour à partir du deuxième tour de téléoconque, alors que les espèces de *Murexiella* en ont 5 à 7. Le genre *Poropteron*, endémique à l'Afrique du Sud, est caractérisé par la présence de courtes épines émoussées sur les varices. Les caractères conchyliologiques de *M. sanctaehelenae* permettent aussi de la rapprocher de *Pterynotus* (Muricinae) et de *Pteropurpura*. J'ai retenu le genre *Pteropurpura* à cause de sa forme générale, de sa sculpture spirale et de ses 3 varices axiales par tour de spire. Le canal siphonal n'est pas soudé, mais cela peut être accidentel ou résulter d'un manque de maturité de l'holotype, récolté mort. L'ouverture assez large et ronde, suggère un opercule arrondi avec un nucleus probablement latéral, comme chez les Ocenebrinae. L'ouverture de *Pterynotus* est plus étroite et plus ovale, à laquelle un opercule avec nucleus apical s'adapte mieux. L'holotype mesure 29,2 mm et est de couleur blanc sale.

***

The generic classification of this species, known only from the holotype, is doubtful. It was included in *Murexiella* (Muricopsinae) by VOKES (1971a: 74) and by FAIR (1976: 75), and in *Poropteron* (Ocenebrinae) by RADWIN & D'ATTILIO (1976: 128). The species of *Murexiella* have 5-7 axial varices from second to last teleoconch whorls, while *P. sanctaehelenae* only have 3 varices. Shells of the genus *Poropteron*, known only from South Africa, are almost smooth, with short, blunt spines on the varices. The shell morphology of *M. sanctahelenae* is also close to *Pterynotus* (Muricinae), and *Pteropurpura*. The genus *Pteropurpura* is here retained because of its general outline, its spiral sculpture, and its 3 axial varices. The siphonal canal is not sealed but this is probably fortuitous (immature or damaged). The broad, rounded aperture is also very close to the aperture of a *Pteropurpura*. The aperture of *Pterynotus* is narrower and more ovate. The holotype is 29.2 mm in length and dirty white.

RAPANINAE Gray, 1853

Morula consanguinea (Smith, 1891)
Figs 261-262

Cantharus (Tritonidea) consanguineus Smith, 1891: 260, pl. 21, fig. 10.

Matériel type examiné: 50 syntypes BMNH 1889.10.1.162-173, 1889.10.1.110-131, 1889.10.1. 2368-70 (dont un de 17,4 mm, Fig. 261, est ici désigné comme lectotype), 1889.10.1.2347-55, 1873.11.19.24, 1857.10.16.11.

Localité type: Sainte Hélène.

Distribution: Ile de Sainte Hélène.

Remarques: *Morula consanguinea* est similaire à *M. nodulosa* (C.B. Adams, 1845) mais elle en diffère par ses nodules plus atténués, ses tours de téléoconque plus étroits, ses cordons spiraux plus espacés, son canal

siphonal comparativement plus long et son ouverture moins, voire non denticulée.

La présence de *Morula nodulosa* n'a pas été signalée à Sainte Hélène.

***

Morula consanguinea is similar to *M. nodulosa* (C.B. Adams, 1845). It differs in its narrower shell, with lower nodes, more broadly spaced spiral cords, relatively longer siphonal canal, and less denticulate, or smooth aperture.

M. nodulosa was not signalized in Saint Helena.

Stramonita bicarinata (De Blainville, 1832)
Figs 255-256

Purpura bicarinata De Blainville, 1832: 215.

Purpura helena Quoy & Gaimard, 1833: 573, pl. 39, figs 7-10.

Matériel type examiné examiné: *P. bicarinata*: 3 syntypes MNHN; *P. helena*: holotype MNHN.

Localité type: Sainte Hélène.

Distribution: Sainte Hélène et Ascension.

Remarques: *Stramonita bicarinata* fut considérée comme sous-espèce de *S. rustica* (Lamarck, 1822), une espèce largement répandue dans l'Atlantique Occidental, par CLENCH (1947: 82). Elle en diffère cependant par la présence de 4 denticules à l'intérieur de la lèvre externe de l'ouverture, au lieu d'être plissée comme chez *S. rustica*.

***

Stramonita bicarinata, described from St Helena, was considered as a subspecies of *S. rustica* (Lamarck, 1822), a common West Atlantic species, by CLENCH (1947: 82). However, it differs from the latter in having four denticles within the outer apertural lip rather than having a lirate aperture.

REFERENCES

ABBOTT, R.T. & S.P. DANCE. 1982. *Compendium of seashells*. E.P. Dutton, Inc. New York: i-ix, 1-410.

ADAMS, A. 1853. Descriptions of several new species of *Murex*, *Rissoina*,*Planaxis*, and *Eulima* from the Cumingian collection. *Proc. Zool. Soc.London* (1851) 19: 267-272.

ADAMS, C.B. 1845. Speciorum novarum conchyliorum Jamaica repertorum synopsis. *Proc. Boston Soc. Nat. Hist.* 2: 3-17.

ADANSON, M. 1757. Histoire des coquillages. In *Histoire Naturelle du Sénégal*. Paris: 1-275

BANDEL, K. 1984. The radulae of Caribbean and other Mesogastropoda and Neogastropoda. *Zool Verhandelingen* 214: 1-188.

BERNARD, P.A. 1984. *Coquillages du Gabon*. Roma: 1-140.

BIRAGHI, G. 1984. New species of Gabon. *Conchiglia* 16(184-185): 13.

DE BLAINVILLE, H.M.D. 1832. Disposition méthodique des espèces récentes et fossiles des genres Pourpre, Ricinule, Licorne et *Concholepas* de M. de Lamarck. *Nouv. Ann. Mus. Hist. Nat., Paris* I: 189-263.

BOUCHET, P. & R. HOUART. 1996. A new genus of Atlantic Muricidae with misleading shell morphology (Mollusca: Gastropoda). *J. Conch.* 35: 423-426.

BOUCHET, P. & A. WARÉN. 1985. Revision of the Northeast Atlantic bathyal and abyssal Neogastropoda excluding Turridae (Mollusca, Gastropoda). *Boll. malac.* suppl. 1: 123-296.

BRODERIP, W.J. & G.B. SOWERBY, 1833. Characters of new species of Mollusca and Conchifera collected by H. Cuming. *Proc. Comm. Sci. Corresp. Zool. Soc. London* 2(1832): 173-179, 194-202.

BURNAY, L.P. 1985. Actualizaçao das informaçaoes existentes sobre as éspecies oeste-Africanas da familia Muricidae (Prosobranchia, Neogastropoda) I. *Chicoreus (Hexaplex) megacerus* (Sowerby, 1834). *Publ. Ocas. Soc. Port. Malac.*: 31-38.

BURNAY, L.P. & R. von COSEL. 1983. *Hexaplex bifasciatus* (A. Adams, 1854), a valid muricid species occuring in the Cape Verde Archipelago. *Boll. Malac.* 19(1-4): 13-24.

CERNOHORSKY, W.O. 1974. Type specimens of Mollusca in the University Zoological Museum, Copenhagen. *Rec. Auckland Inst. Mus.* 11: 143-192.

CERNORHORSKY, W.O. 1978. The taxonomy of some Indo-Pacific Mollusca, pt. 6. *Rec. Auckland Inst. Mus.* 15: 67-86.

CHEMNITZ, J.H. 1788. *Neues systematisches Conchylien-Cabinet*. Nürnberg, Vol. 10, i-xxiv, 1-376.

CLENCH, W.J. 1947. The genera *Purpura* and *Thais* in the Western Atlantic. *Johnsonia* 2(23): 61-69.

CLENCH, W.J. & R.D. TURNER. 1948. A new *Thais* from Angola and notes on *Thais haemastoma* Linnaeus. *Amer. Mus. Novitates* 1374: 1-4.

DALL, W.H. 1889. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877-78) and in the Caribbean Sea (1879-80), by the U.S. Coast Survey steamer "Blake" Lieut. Commander C.D. Sigsbee, U.S.N, and Commander J.R. Bartlett, U.S.N., commanding. XXIX. Report on the Mollusca. Part 2, Gastropoda and Scaphopoda. *Bull. Mus. Comp. Zool.* 18: 1-492.

D'ATTILIO, A. 1985. Comments on the muricine genus *Purpurellus* Jousseaume, 1880. *Festivus* 17(11): 115-118.

D'ATTILIO, A. & C.M. HERTZ. 1989. A note on *Pterotyphis pinnatus* (Broderip, 1833). *Festivus* 21(11): 105.

DAUTZENBERG, P. 1891. Voyage de la goélette "Melita" aux Canaries et au Sénégal. *Mém. Soc. Zool. Fr.* 4: 16-65.

DAUTZENBERG, P. 1910. Contribution à la faune malacologique de l'Afrique Occidentale. *Actes Soc. Linn. Bordeaux*: 1-174.

DELEMARRE, J.L. 1995. Voyage aux Bijagós. *Xenophora* 71: 37-38.

DILLWYN, L.W. 1817. *A descriptive catalogue of Recent shells, arranged according to the Linnean method, with particular attention to the synonymy.* London, Vol. 1: i-xii, 1-580; vol. 2: 581-1092 + index.

DODGE, H. 1957. An historical review of the mollusks of Linnaeus. *Bull. Amer. Mus. Nat. Hist. 5, Murex*, 113(2): 73-224.

DUNKER, G. 1853. *Index Molluscorum quae in itinere ad Guineam inferiorem collegit Georgius Tams Med. Dr.*: 1-74.

DUNKER, G. 1879. Mollusca quaedam nova. *J. Conchyl.* 27: 212-217.

DUVAL, A. 1853. Description d'une espèce nouvelle de *Murex*. *J. Conchyl.* 4: 203-204.

EMERSON, W.K. & A. D'ATTILIO. 1969. Remarks on the taxonomic placement of *Purpurellus* Jousseaume, 1880, with the description of a new species. *The Veliger* 12(1): 145-148.

EMERSON, W.K. & A. D'ATTILIO. 1979. Six new living species of Muricacean Gastropoda. *The Nautilus* 93(1): 1-10.

EUTHYME (Le Frère). 1889. Description de quelques espèces nouvelles de la faune marine exotique. *Bull. Soc. Malac. France* 6: 259-282.

FAIR, R.H. 1976. *The* Murex *Book, an illustrated catalogue of Recent* Muricidae *(Muricinae, Muricopsinae, Ocenebrinae).* Honolulu: 1-138.

FECHTER, R. 1977. Zwei bemerkenswerte muriciden (Mollusca, Gastropoda) aus dem mittleren Ostatlantik. *Spixiana* 1(2): 151-164.

FERNANDES, F. & E. ROLÁN. 1990a. Nuevo genero y nuevas especies de la familia Buccinidae Rafinesque, 1815 (Mollusca, Neogastropoda) de la Isla de Sao Tomé. *Boll. Malac.* 25(9-12): 341-348.

FERNANDES, F. & E. ROLÁN. 1990. *Paradoxon* nomen novum pro *Paradoxa* Fernandes & Rolan, 1989 (Mollusca, Neogastropoda). *Boll. Malac.* 22(1-4): 67.

FERNANDES, F. & E. ROLÁN. 1993. *Pradoxa* nomen novum pro *Paradoxon* Fernandes y Rolán, 1990. *Iberus* 11(1): 61.

FISCHER, P. 1876. Description d'espèces nouvelles de l'Afrique occidentale. *J. Conchyl.* 24: 236-240.

FISCHER-PIETTE, E. 1942. Les Mollusques d'Adanson. *J. Conchyl.* 85: 103-374.

FUJIOKA, Y. 1985. Systematic evaluation of radular characters in Thaidine (Gastropoda: Muricidae). *J. Sci. Hiroshima Univ.* ser. B div. 1, 31: 235-287.

GMELIN, J.F. 1791. *Caroli a Linnaeus Systema naturae per regna tria naturae*. Editio 13, Vol. 1(6), cl. 6, Vermes, Lipsiae: 3021-3910.

GOFAS, S., J. PINTO AFONSO & M. BRANDAO. 1985. *Conchas e Moluscos de Angola.* Elf Aquitaine, Angola: 1-144.

GUPPY, R.J.L. 1869. Notice of some new marine shells found on the shores of Trinitad. *Proc. Sci. Assoc. Trinitad* 1(7): 366-369.

HINDS, R.B. 1844. On new species of *Scalaria* and *Murex*. *Proc. Zool. Soc.* 11: 124-129.

HOUART, R. 1979. *Ocenebra fairiana*, espèce nouvelle de la famille des Muricidae. *Inf. Soc. belge Malac.* 7(1): 3-4.

HOUART, R. 1980. Description et illustration d'un deuxième exemplaire de *Murexiella (Subpterynotus) exquisitus* (Sowerby, 1904) (Gastropoda: Muricidae: Muricopsinae). *Inf. Soc. Belge Malac.* 8(4): 79-83.

HOUART, R. 1981. *Murexiella (Subpterynotus) exquisitus* (Sowerby, 1904): quelques renseignements complémentaires. *Inf. Soc. Belge Malac.* 9(3): 83-84.

HOUART, R. 1981. *Favartia burnayi*, espèce nouvelle de la sous-famille des Muricopsinae (Gastropoda: Muricidae). *Inf. Soc. belge Malac.* 9(3): 79-82.

HOUART, R. 1982. Note concernant trois espèces d'Ocenebrinae (Gastropoda:Muricidae) d'Afrique Occidentale. *Boll. Malac.* 18(5-6): 129-132.

HOUART, R. 1984. *Ocenebra isaacsi* sp. nov., a new muricid from Ghana, West (Muricidae: Ocenebrinae). *Boll. Malac.* 20(1-4): 83-88.

HOUART, R. 1989. Description of a new species of *Ocenebra* (Muricidae: Ocenebrinae) from Western Africa. *Publ. Ocas. Soc. Port. Malac.* 13: 63-64.

HOUART, R. 1990. Description of two new subspecies of *Muricopsis (Risomurex)* (Muricidae: Muricopsinae) from Angola, Western Africa. *Publ. Ocas. Soc. Port. Malac.* 15: 53-58.

HOUART, R. 1992. The genus *Chicoreus* and related genera (Gastropoda: Muricidae) in the Indo-West Pacific. *Mém. Mus. natn. Hist. nat.* (A) 154: 1-188.

HOUART, R. 1993. Description of three new species and one new subspecies of Muricidae (Muricinae and Muricopsinae) from West Africa. *Boll. Malac.* 29(1-4): 17-30.

HOUART, R. 1995. The Ergalataxinae (Gastropoda, Muricidae) from the New Caledonia region with some comments on the subfamily and the description of thirteen new species from the Indo-West Pacific. *Bull. Mus. natl. Hist. nat.*, Paris, 4e sér., 16, section A, n° 2-4: 245-197.

HOUART, R. 1996a. Description of new species of Muricidae (Gastropoda) from New Caledonia, the Philippine Islands, the Northeast Atlantic, and West Africa. *Apex* 11(2): 59-75.

HOUART, R. 1996b. Les Muricidae d'Afrique Occidentale (The West African Muricidae) I. Muricinae & Muricopsinae. *Apex* 11(3-4): 95-161.

HOUART, R. & A.D. ABREU. 1994. The Muricidae (Gastropoda) from Madeira with the description of a new species of *Ocenebra (Ocinebrina)* (Muricidae: Ocenebrinae). *Apex* 9(4): 119-130.

HOUART, R. & F.C. AZNAR. 1982. *Trophon fraseri* Knudsen, 1956 (Gastropoda: Muricidae: Trophoninae), une espèce d'Afrique Occidentale récemment trouvée en Europe. *Inf. Soc. belge Malac.* 10(1-4): 127-130.

JOUSSEAUME, F. 1874. Description de quelques espèces nouvelles de coquilles appartenant aux genres *Murex, Cypraea* et *Natica. Rev. Mag.Zool.*: 3-25.

KAICHER, S.D. 1980. *Card catalogue of world-wide shells*: Muricidae (5), St. Petersburg, Florida.

KIENER, L.C.. 1842-1843. *Spécies général et iconographie des coquilles vivantes...*, Vol. 7, Rocher (*Murex*): 1-130, text (1842); pls 1-47 (1843).

KNUDSEN, J. 1950. Egg capsules and development of some marine prosobranchs from Tropical West Africa. *Atlantide Rep.* 1: 85-130.

KNUDSEN, J. 1956. Marine prosobranchs of West Africa. *Atlantide Rep.* 4: 7-110.

KOOL, S.P. 1993. The systematic position of the genus *Nucella* (Prosobranchia: Muricidae: Ocenebrinae). *The Nautilus* 107(2): 43-57.

LAMARCK, J.B.P.A. de M. de. 1816. *Tableau encyclopédique et méthodique des trois règnes de la nature, 23e part., mollusques et polypes divers.* Paris: pls 391-488.

LAMARCK, J.B.P.A. de M. de. 1822. *Histoire naturelle des animaux sans vertèbres* 7. Paris: 1-232.

LINNAEUS, C. von. 1758. *Systema naturae per regna tria naturae*, 10e edit., 1. Stockholm: 1-824.

LINNAEUS, C. von. 1767. *Systema naturae per regna tria naturae*, 12e edit., 2. Stockholm: 533-1327.

LOCARD, A. 1897. *Expédition scientifique du "Travailleur" et du "Talisman"* 1. Paris: 1-515.

MALTZAN, H.F. von. 1884. Diagnosen neuer Senegambischen gastropoden. *Jahrb. D. Malak. Gesell.* 16(5): 65-73.

MARCHE-MARCHAD, I. 1958. Nouveau catalogue de la collection de mollusques testacés de l'IFAN. *Catalogues Ifan* 14: 1-64.

MARTINI, F.H.W. 1777. *Neues Systematisches Conchylien Cabinet*, Vol. 3. Nüremberg: 1-434.

NICKLES, M. 1950. *Mollusques testacés marins de la côtes occidentale d'Afrique*. Manuels Ouest-Africains, Lechevalier, Paris: 1-269.

NICOLAY, K. 1972. A new *Murex* from the coast of Senegal. *La Conchiglia* 4(37): 11.

NORDSIECK, F. 1975. Some trips to the Canary Islands (Part 2). *La Conchiglia* 7(75-76): 3-7 & 22.

NORDSIECK, F. & F. GARCIA-TALAVERA. 1979. *Moluscos marinos de Canarias y Madera.* Aula de Cultura de Tenerife: 1-208.

ODHNER, N.H. 1922. Contributions to the marine molluscan fauna of South and West Africa. *Medd. fran Göteborgs Musei Zoologiska Avdelning* 26: 1-39.

PAIN, T. 1976. The Muricinae of the West African marine province. *British Shell coll. Newsletter* 24: 1-7.

PASTEUR-HUMBERT, C. 1962. Les mollusques marins testacés du Maroc. Catalogue non critique. I. Les gastéropodes. *Trav. Inst. scient. Chérifien*, sér. Zoologie 23: 1-203.

PERRY, G. 1811. *Conchology, or the natural history of snails...* : 1-4, 61 pls. Miller, London.

PETIT DE LA SAUSSAYE, S. 1840. Description de deux espèces de coquilles nouvelles appartenant aux genres *Rostellaria* et *Murex. Revue Mag. Zool.* 3: 326-327.

PHILIPPI, R.A. 1845-51. *Abbildungen und beschreibungen neuer oder wenig gekannter Conchylien*. 3 vol., 24 pt., Cassel.

POIRIER, J. 1883. Révision des *Murex* du Muséum. *Nouvelles Archives du Muséum d'Histoire Naturelle* 2(5): 13-128.

PONDER, W.F. and E.H. VOKES. 1988. A revision of the Indo-West Pacific fossil and Recent species of *Murex* s.s. and *Haustellum* (Mollusca: Gastropoda: Muricidae). *Rec. Australian Mus.*, suppl. 8: 1-160.

QUOY, J.R.C. and J.P. GAIMARD. 1833. *Voyage de découvertes de "L'Astrolabe" exécuté par ordre du Roi, pendant les années 1826-1827-1828-1829, sous le commandement de M.J. Dumont d'Urville.* Zoologie 2: 321-674.

RADWIN, G. & A. D'ATTILIO. 1976. *Murex shells of the world, an illustrated guide to the Muricidae.* Stanford: 1-284.

REEVE, L.A. 1845. *Conchologia Iconica, or illustrations of the shells of molluscous animals*, 3, *Murex.* Reeve, London: 26 pls.

REEVE, L.A. 1846. *Conchologia Iconica, or illustrations of the shells of molluscous animals*, 3, *Ricinula.* Reeve, London: 16 pls.

REEVE, L.A. 1849. *Conchologia Iconica, or illustrations of the shells of molluscous animals, Murex*, suppl. 1. Reeve, London.

RIOS, E.C. 1970. *Coastal Brazilian seashells.* Rio Grande, R.S.: 1-255.

RIOS, E.C. 1985. *Seashells of Brazil.* Rio Grande, R.S.: 1-328.

RÖDING, J.F. 1798. *Museum Boltenianum sive Catalogus cimeliorum e tribus regnis naturae quae olim collegerat J. F. Bolten*, M.D. p.d., Hamburg: 1-199.

ROLÁN, E. & F. FERNANDES. 1991. *Muricopsis (Risomurex)* (Gastropoda, Muricidae) de las islas de Sao Tomé y Principe (Golfo de Guinea, Africa Occidental). *Apex* 6(1-2): 11-20.

ROLÁN, E., & F. FERNANDES. 1991. *Coralliophila adansoni* (Kosuge & Fernandes, 1989) new name for *Ocinebrina adansoni*. *Boll. Malac.* 26(5-9): 143-144.

RYALL, P. 1984. Separation means differences. *Hawaiian Shell News* 32(8):3.

SCHUBERT G.W. & J.A. WAGNER. 1829. *Neue Systematisches Conchylien-Cabinet angefangen von Martini und Chemnitz*. Nürnberg.

SCHUMACHER, H.C.F. 1817. *Essais d'un nouveau système des vers testacés*. Schultze, Copenhagen: 1-287.

SCHWENGEL, J. 1943. New marine shells from Florida. *The Nautilus* 56(3): 76-77.

SMITH, E.A. 1891. Report on the marine molluscan fauna of the Island of St. Helena. *Proc. Zool. Soc. London:* 247-317 (1890).

SMITH, M. 1946. New Caribbean and Panamic shells and a Pliocene *Marginella*. *The Nautilus* 60(2): 60-62.

SOWERBY, G.B. 1834-41. The Conchological illustrations, *Murex*. Sowerby, London: pls 58-67; 1841: pl. 187-99 and catalogue: 1-9.

SOWERBY, G.B. 1841. Descriptions of some new species of *Murex*, principally from the collection of H. Cuming Esq. *Proc. Zool. Soc. London* (1840): 137-147.

SOWERBY, G.B. 1874. Descriptions of twelve new species of shells. *Proc. Zool. Soc. London* (for 1873): 718-722.

SOWERBY, G.B. 1879. *Thesaurus Conchyliorum. Monograph of the genus Murex*, 4, (33-34). Sowerby, F.L.S., London: 1-155.

SOWERBY, G.B. 1904. Description of six new species of marine mollusca from the collection of the late Admiral Keppel. *Proc. Malac. Soc. London* 6: 174-77.

SWAINSON, W. 1820-33. *The Zoological illustrations, or original figures and descriptions of new, rare, or interesting animals, selected chiefly from the classes of ornithology, entomology, and conchology*. London, ser. 1, vols 1-3, pls 1-182 (1820-23); ser. 2, vols 1-3, pls 1-136 (1829-33).

THIELE, J. 1925. Gastropoda der Deutschen Tiefsee Expedition. II Teil, wissenschaftenliche ergebnisse der Deutsche Tiefsee-Expedition aus dem dampfer Valdivia 1898, 1899, 17(2): 38-382.

THIELE, J. 1929 - 1931. *Handbuch der systematischen Weichtierkunde*. Jena, Gustav Fischer: 1-1154.

TRÖNDLÉ, J. & R. HOUART. 1992. Les Muricidae de Polynésie Française. *Apex* 7(3-4): 67-149.

TRYON, G.W. 1880. *Manual of Conchology, 2,* Muricinae, Purpurinae. Philadelphia: 1-289.

VERMEIJ, G.J., & R. HOUART. 1996. The genus *Jaton* (Muricidae, Ocenebrinae), with the description of a new species from Angola, West Africa. *Iberus* 14(1): 83-91.

VOKES, E.H. 1964. Supraspecific groups in the subfamilies Muricinae & Tritonaliinae (Gastropoda: Muricidae). *Malacologia* 2(1): 1-41.

VOKES, E.H. 1971a. Catalogue of the genus *Murex* Linnaeus (Mollusca: Gastropoda). Muricinae, Ocenebrinae. *Bull. Am. Paleont.* 61(268): 1-141.

VOKES, E.H. 1971b. The geologic history of the Muricinae and the Ocenebrinae. *The Echo* 4: 37-54.

VOKES, E.H. 1973. *Murex varius* Sowerby, and the systematic validity of the genus *Hexaplex* (Gastropoda: Muricidae). *Of Sea & Shore*, Spring: 15.

VOKES, E.H. 1989. Neogene Paleontology in the northern Dominican Republic. 8. The family Muricidae (Mollusca: Gastropoda). *Bull. Amer. Paleontology* 97(332): 5-94.

VOKES, E.H. 1992. Cenozoic Muricidae of the western Atlantic region. Part IX - *Pterynotus, Poirieria, Aspella, Dermomurex, Calotrophon, Acantholabia* and *Attiliosa*; additions and corrections. *Tulane Stud. Geol. Paleont.* 25(1-3): 1-108.

VOKES, E.H. 1996. Cenozoic Muricidae of the western Atlantic region. Part XI - the subfamily Ergataxinae. *Tulane Stud. Geol. Paleont.* 29(2): 27-44.

VOKES, E.H. & R. HOUART. 1986a. An evaluation of the taxa *Muricopsis* and *Risomurex* (Gastropoda: Muricidae), with one new species of *Risomurex*. *Tulane Stud. Geol. Paleont.* 19(1-2): 63-88.

VOKES, E.H. & R. HOUART. 1986b. A new species of *Muricopsis (Risomurex)* from West Africa. *Tulane Stud. Geol. Paleont.* 19(1-2): 88-89.

WATSON, R.B. 1897. On the marine Mollusca of Madeira, with descriptions of thirty-five new species, and an index-list of all known sea-dwelling species of that island. *J. Linn. Soc.* 26: 233-329.

PLANCHES

PLATES

Figures 163-171 (radulas). (échelles: 163, 168 = 50 µm; 164-166, 169-170 = 10 µm; 167 = 100 µm).

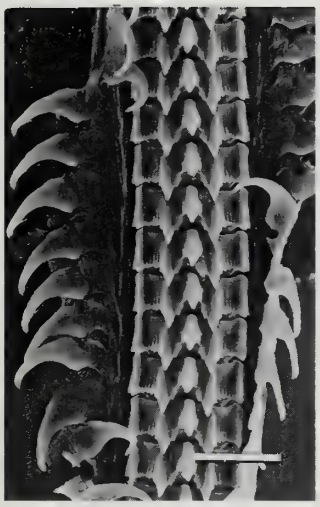
163-164. *Pteropurpura dearmatus benderskyi* Emerson & D'Attilio, 1979, Angola.

165-166. *Ocenebra coseli* Houart, 1989, Gabon.

167-168. *Ocenebra inermicosta* (Vokes, 1964), Luanda, Angola.

169-170. *Ocenebra isaacsi* Houart, 1984, Angola.

171. *Ocenebra gruveli* (Dautzenberg, 1910), Mauritanie.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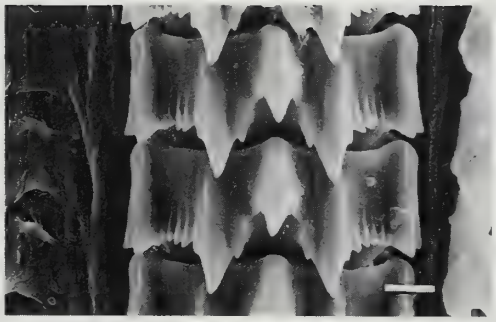
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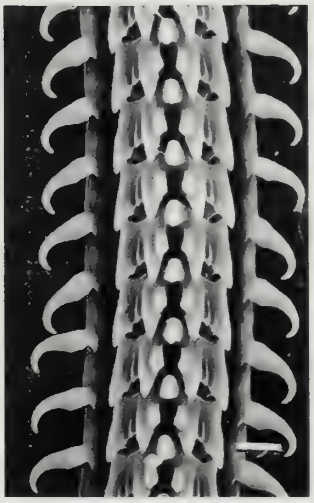
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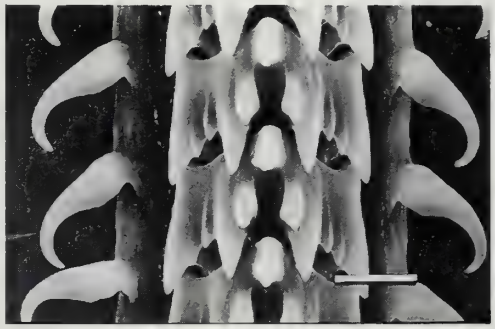
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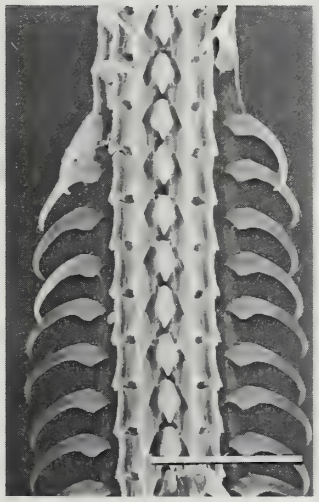
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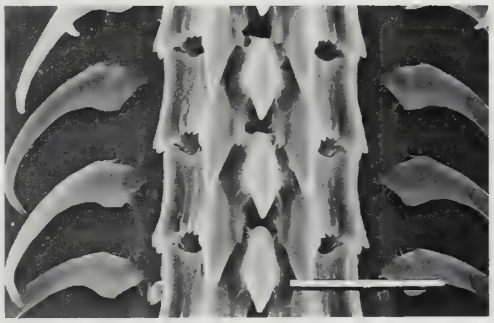
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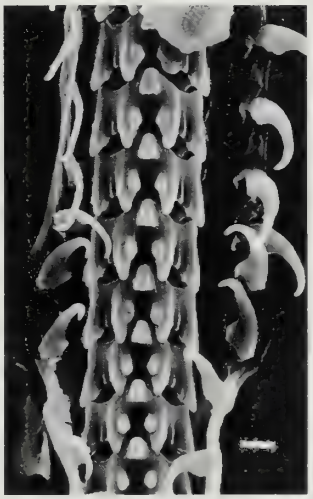
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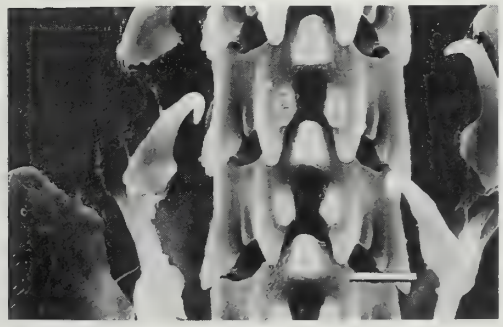
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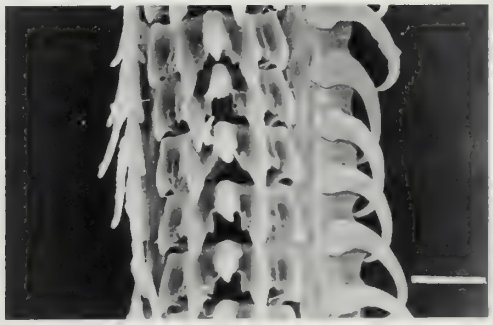
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Figures 172-179 (radulas). (échelles: 172, 175, 178-179 = 20 µm; 173 = 10 µm; 174, 176-177 = 50 µm).

172-173. *Chicocenebra gubbi* (Reeve, 1846), Angola, juvénile de 15,9 mm, MNHN.

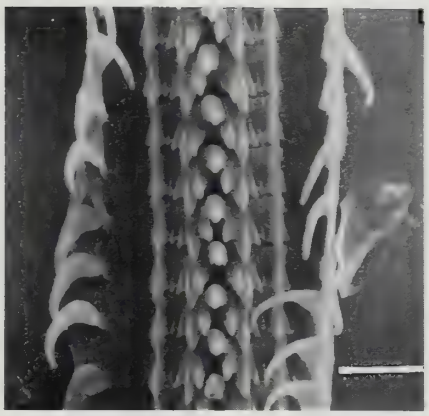
174-175. *Morula nodulosa* (C.B. Adams, 1845), São Tomé.

176. *Thais (Thaisella) coronata* (Lamarck, 1816), Dahomey.

177. *Thais (Thaisella) callifera* (Lamarck, 1822), Congo.

178. *Trachypollia turricula* (von Maltzan, 1884), Bengo, Angola.

179. *Trophonopsis fraseri* (Knudsen, 1956), 17°59' N, 16°38 W.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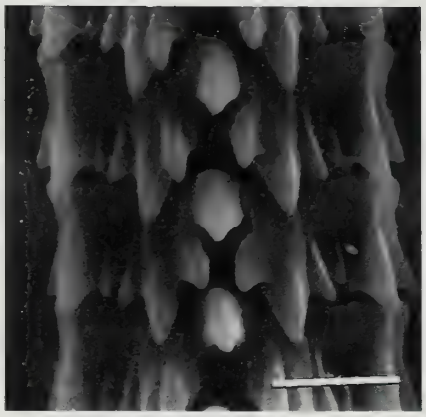
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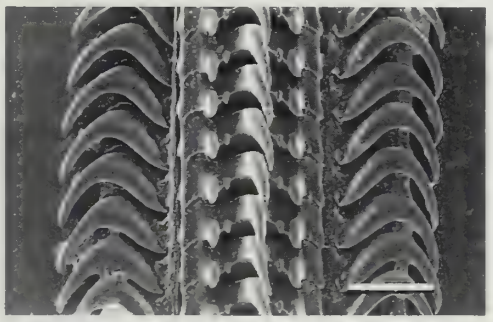
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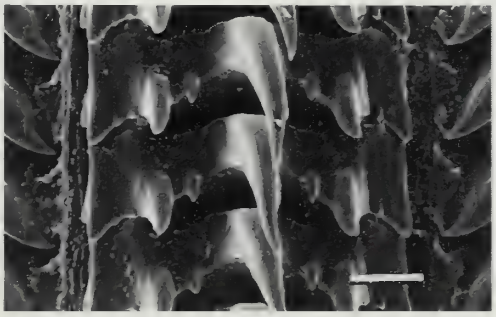
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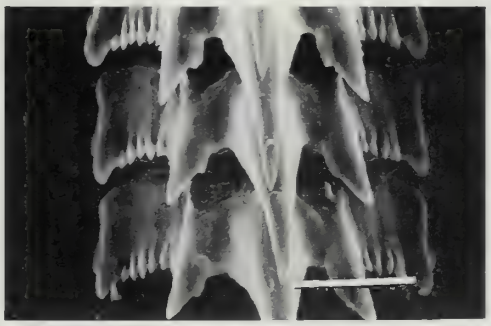
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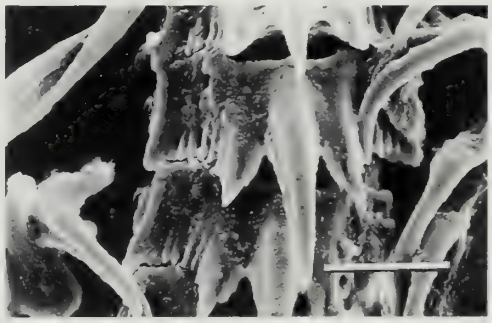
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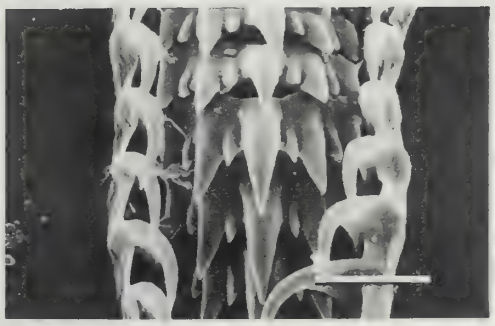
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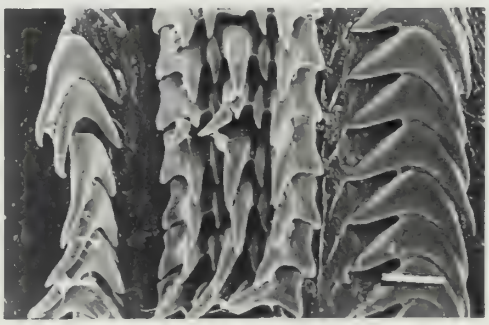
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Figures 180-188 (protoconques). (échelles = 0,5 mm).

180. *Ocenebra coseli* Houart, 1989.

181. *Chicocenebra gubbi* (Reeve, 1849).

182. *Ocenebra inermicosta* (Vokes, 1964).

183. *Ocenebra isaacsi* Houart, 1984.

184-185. *Pteropurpura dearmatus fairiana* (Houart, 1979).

186. *Ocenebra gruveli* (Dautzenberg, 1910).

187. *Pteropurpura dearmatus benderskyi* Emerson & D'Attilio, 1979.

188. *Jaton decussatus* (Gmelin, 1791).

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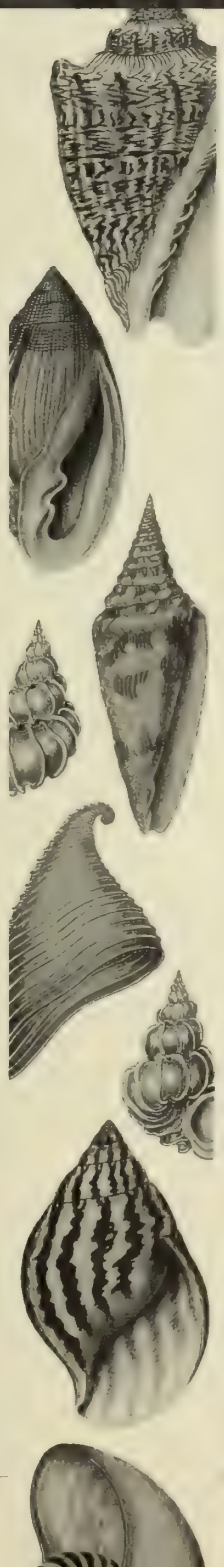

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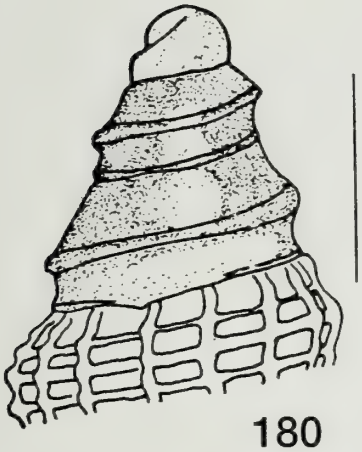

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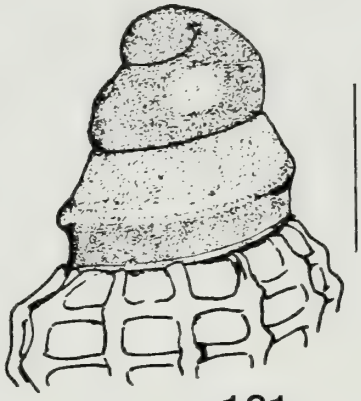

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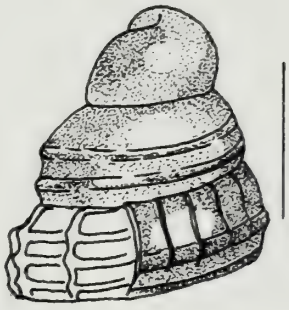

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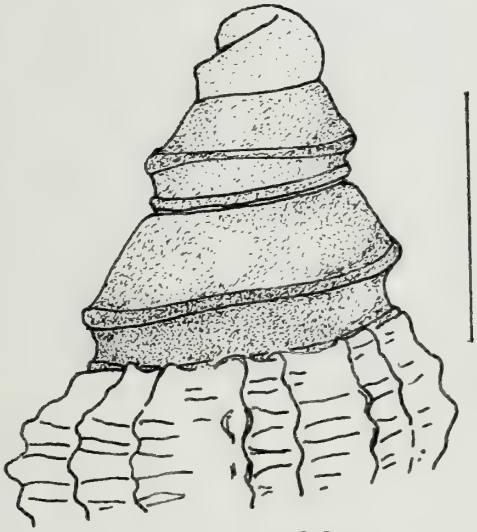

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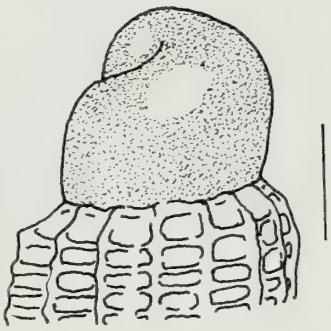

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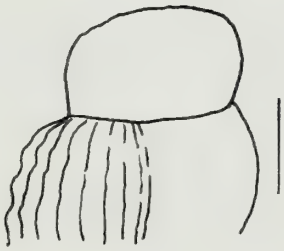

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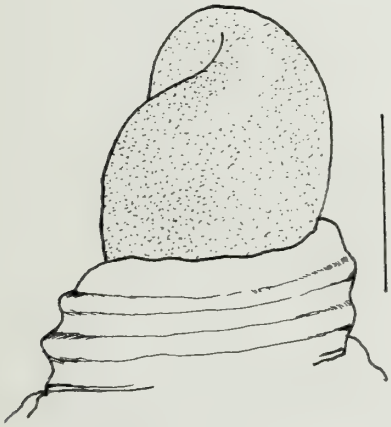

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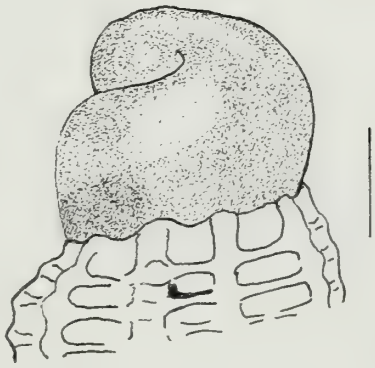

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188

Figures 189-197 (protoconques). (échelles = 0,5 mm).

189. *Jaton flavidus* (Jousseaume, 1874).

190. *Jaton sinespina* Vermeij & Houart, 1996.

191. *Cytharomorula grayi* (Dall, 1889).

192. *Trachypollia turricula* (von Maltzan, 1884).

193. *Orania fusulus* (Brocchi, 1814).

194. *Typhis (Typhina) belcheri* Broderip, 1833.

195. *Thais (Thaisella) coronata* (Lamarck, 1816).

196. *Stramonita haemastoma* (Linnaeus, 1767).

197. *Morula nodulosa* (C.B. Adams, 1845).

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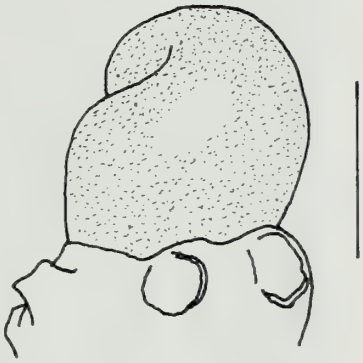

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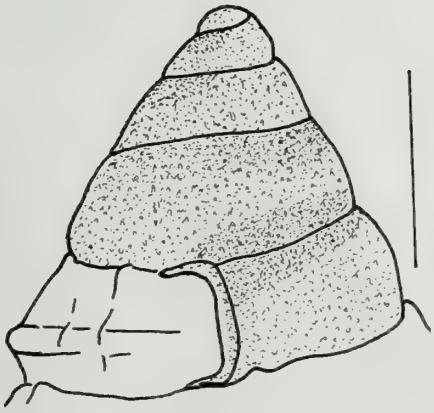

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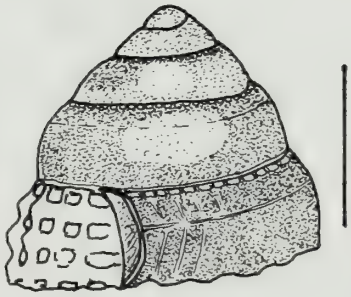

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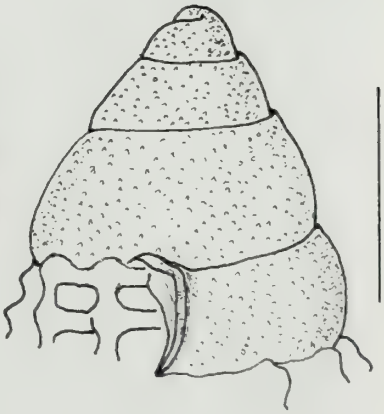

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Figures 198-209.

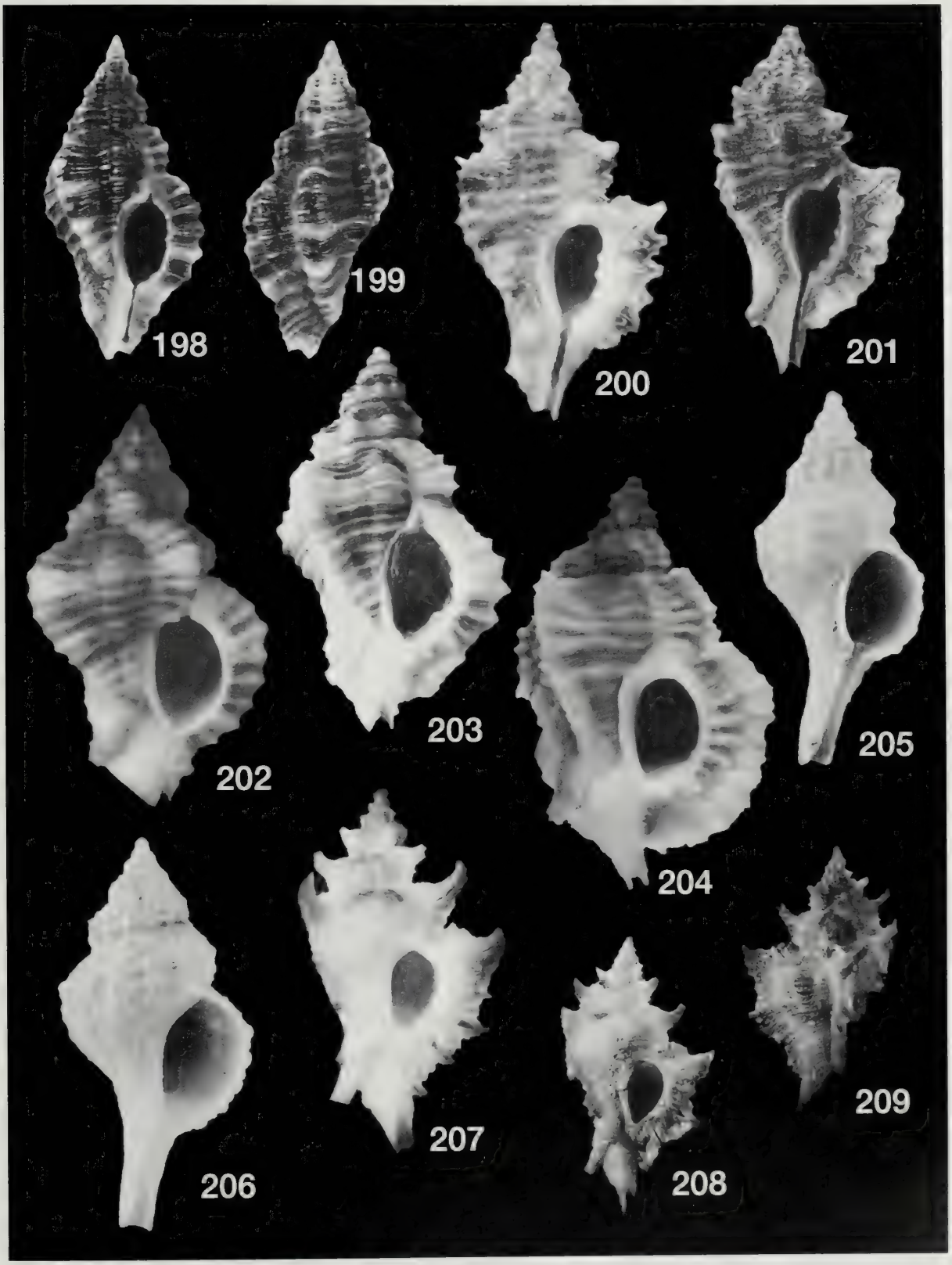
198-199. *Ocenebra coseli* Houart, 1989, Cap Esterias, Gabon, holotype MNHN, 9,3 mm.

200-201. *Ocenebra isaacsi* Houart, 1983 :
200. Pointe Noire, Congo, MNHN, 17,3 mm ;
201. Gabon, RH, 13 mm.

202-204. *Ocenebra inermicosta* (Vokes, 1964) :
202. Gambie, RH, 33 mm ;
203. Pointe Noire, Congo, coll. Hattenberger, 24,9 mm ;
204. Luanda Bay, Angola, RH, 31,8 mm.

205-206. *Ocenebra gruveli* (Dautzenberg, 1910), Mauritanie, IRSNB IG 10591 :
205. 10,3 mm;
206. 11 mm.

207-209. *Pteropurpura dearmatus benderskyi* Emerson & D'Attilio, 1979 :
207. Luanda, Angola, MNHN, 17,5 mm ;
208-209. Luanda, Angola, holotype AMNH 183819, 23 mm, photo W.K. Emerson.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Figures 210-219.

210. *Pteropurpura dearmatus dearmatus* (Odhner, 1922), Porto Alexander, Angola holotype Naturhistoriska Mus., Göteborg, 22,1 mm.

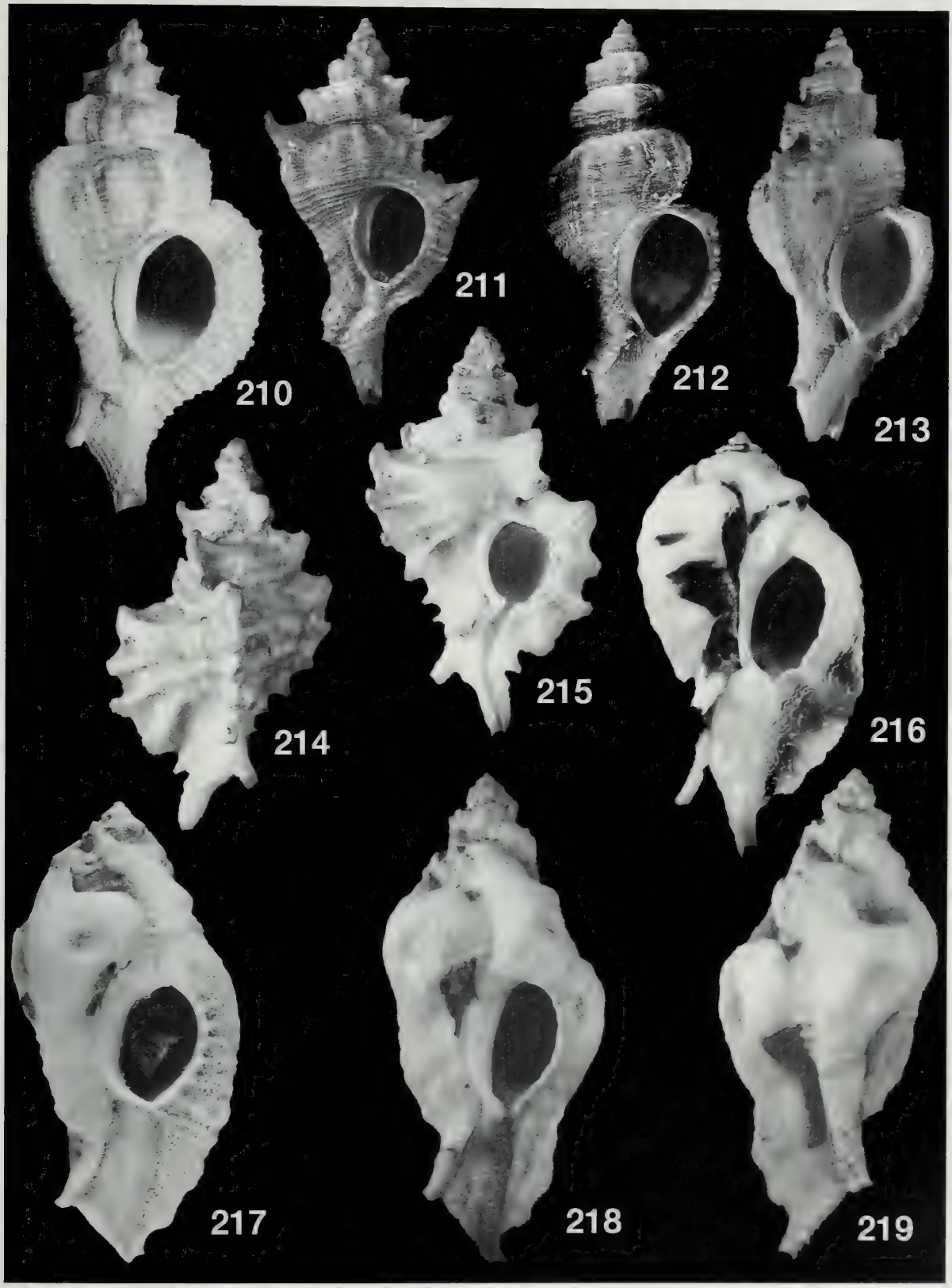
211. *Pteropurpura dearmatus benderskyi* Emerson & D'Attilio, 1979, Luanda, Angola, MNHN, 26,5 mm.

212-213. *Pteropurpura dearmatus fairiana* (Houart, 1979) :
212. Cap Fria, Namibie, Holotype IRSNB IG 25886/320, 33 mm ;
213. Cap Fria, Namibie, paratype RH, 27 mm.

214-215. *Pteropurpura sanctaehelenae* (Smith, 1891), Ste Hélène, holotype BMNH 1889.10.1.2387, 29,2 mm.

216. *Jaton decussatus* (Gmelin, 1791), Gorée, Sénégal, RH, 35,8 mm.

217-219. *Jaton sinespina* Vermeij & Houart, 1996 :
217. Lucira, Angola, holotype MNHN, 50,3 mm ;
218-219. Lucira, Angola, paratype MNHN, 52,1 mm.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Figures 220-232.

220-221. *Jaton flavidus* (Jousseaume, 1874) :
220. Holotype MNHN, 37,5 mm ;
221. Baie de Gorée, Sénégal, RH, 36,5 mm.

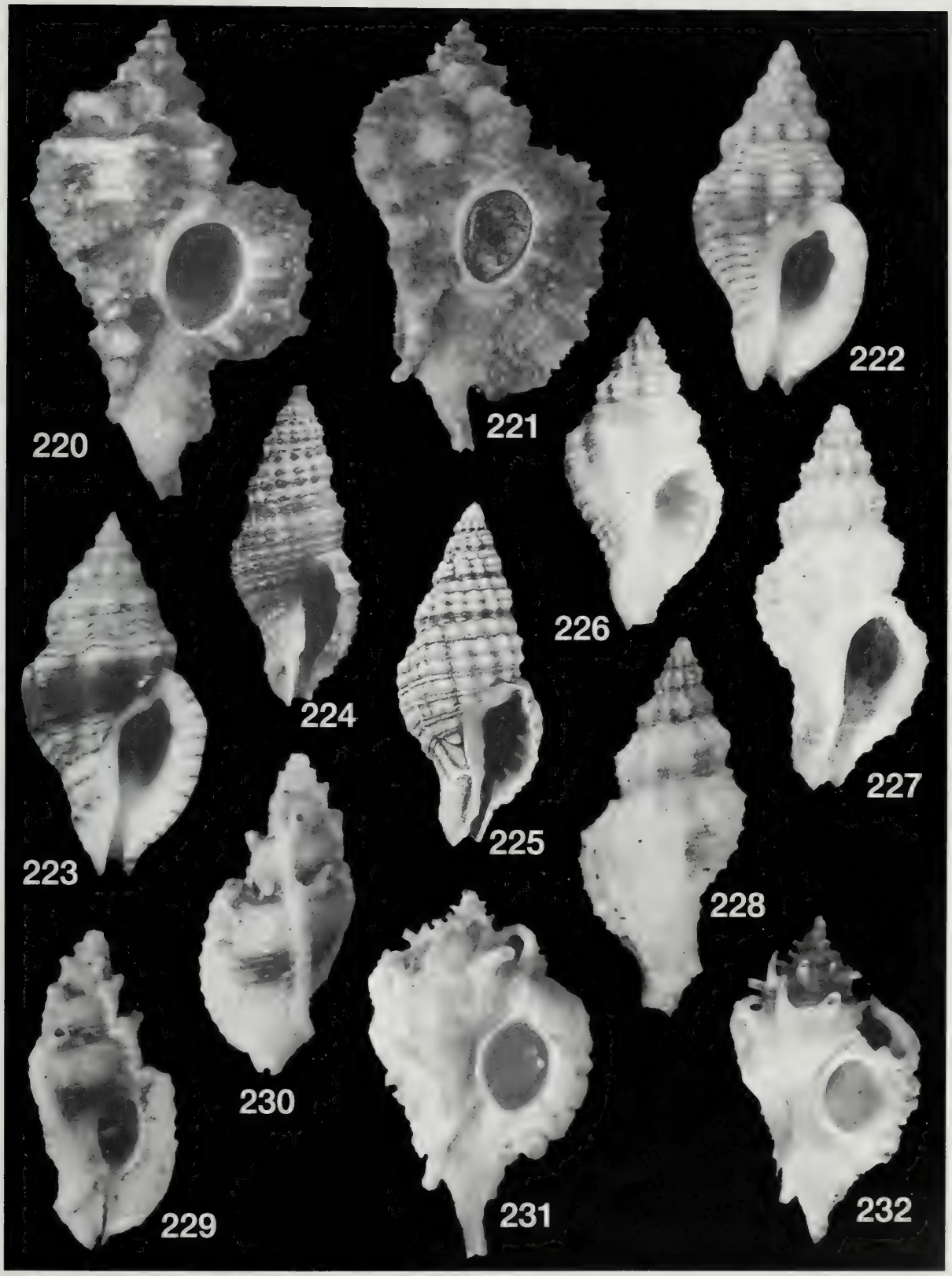
222-223. *Cytharomorula grayi* (Dall, 1889), Tenerife, Iles Canaries, RH :
222: 17 mm; ;
223: 17,1 mm.

224-225. *Trachypollia turricula* (von Maltzan, 1884) :
224. Gorée, Sénégal, holotype ZMB 37205, 12,5 mm ;
225. Angola, USNM, 11 mm, photo E.H. Vokes.

226-228. *Orania fusulus* (Brocchi, 1814) :
226. Holotype de *Murex angolensis* Odhner, 1922, Porto Alexander, Angola, Naturhistoriska Mus., Göteborg, 14 mm ;
227-228. Angola, RH ; 227: 22 mm; 228: 21,5 mm.

229-230. *Pterotyphis ryalli* Houart, 1996, Takoradi, Ghana, paratype coll. P. Ryall, 11,1 mm.

231-232. *Typhis (Typhina) belcheri* Broderip, 1833 :
231. Syntype de *Typhis cleryi* Petit de la Saussaye, 1840, Brésil, MNHN, 17,9 mm ;
232. Syntype de *T. belcheri,* Cap Blanc, Mauritanie, BMNH 197469, 15,9 mm.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Figures 233-239.

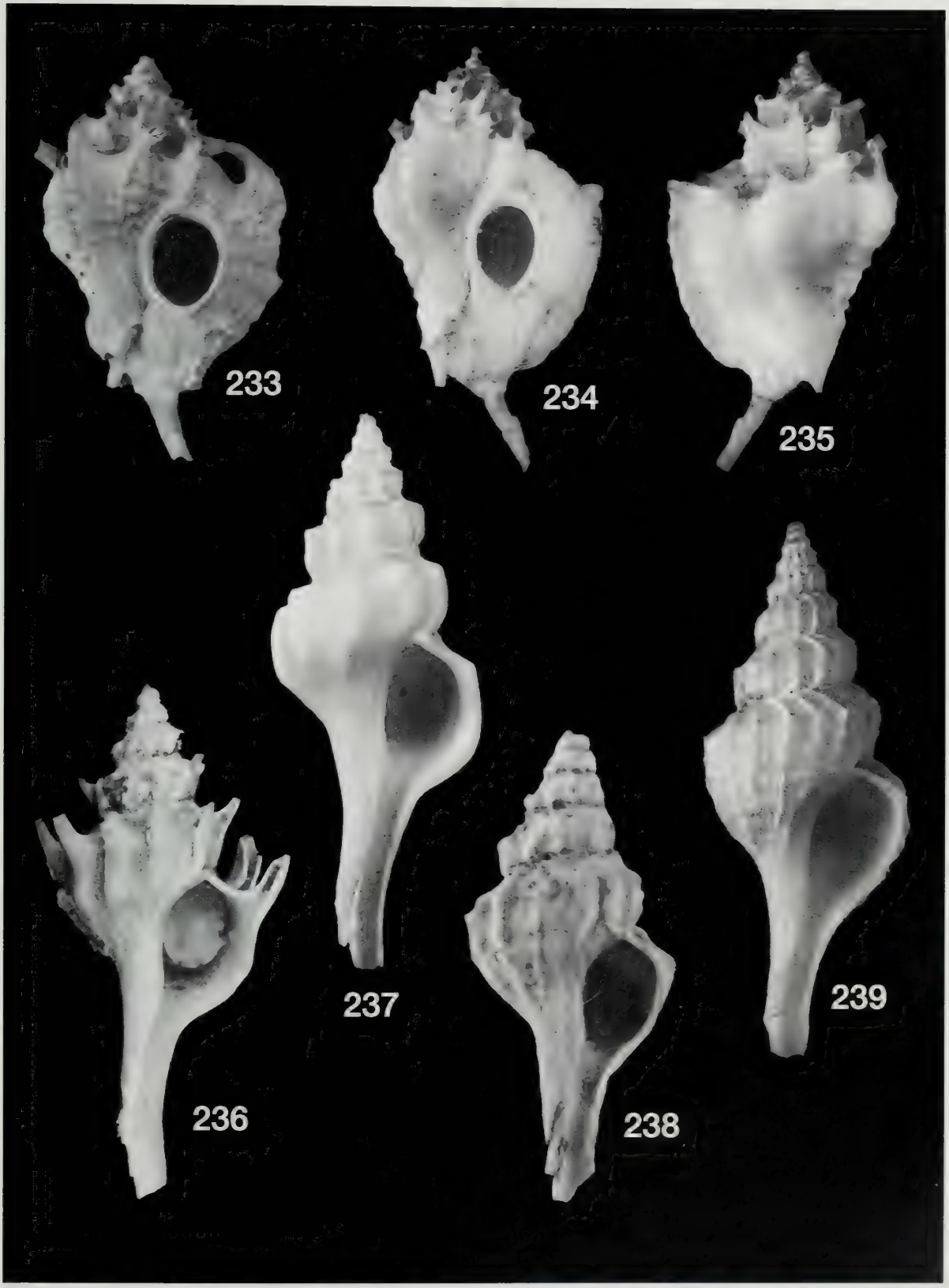
233. *Typhis (Typhina) belcheri* Broderip, 1833, Mauritanie, MNHN, 20,5 mm.

234-235. *Typhis (Talityphis) expansus* Sowerby, 1874, Ile Banié, Gabon, coll P. Bernard, 22,3 mm.

236-237. *Boreotrophon fraseri* (Knudsen, 1956) :
236. Guinée, holotype ZMC, 30,8 mm ;
237. "Afrique Occidentale", RH, 38 mm.

238. *Trophonopsis guineensis* (Thiele, 1925), Golfe de Guinée, holotype ZMB, 12,6 mm.

239. *Trophonopsis cossmanni* (Locard, 1897), Ouest du Sénégal, syntype MNHN, 26 mm.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Figures 240-248.

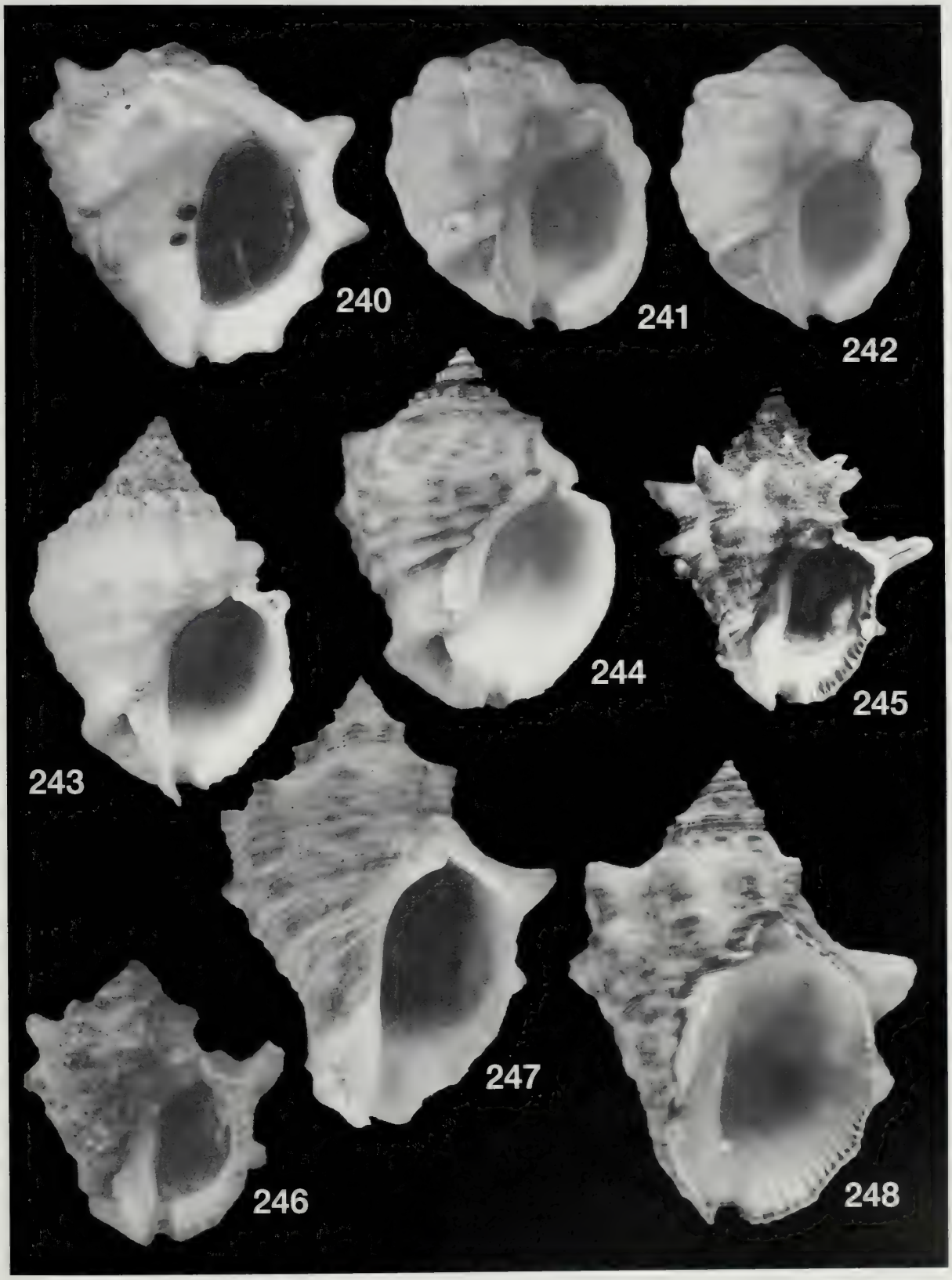
240. *Thais (Thais) nodosa* (Linnaeus, 1758), Sierra Leone, RH, 41 mm.

241-242. *Thais (Thaisella) callifera* (Lamarck, 1822), Congo, IRSNB IG 10591 :
241. 35 mm; 242. 34 mm.

243-244. *Thais (Thaisella) coronata* (Lamarck, 1816), Dahomey, IRSNB IG 10591 :
243. 46,5 mm; 244. 44,5 mm.

245-246. *Thais (Thaisella) langi* Clench & Turner, 1948, Congo, RH.
245. 34,5 mm; 246. 28,1 mm.

247-248. *Stramonita haemastoma* (Linnaeus, 1767) :
247. Holotype de *Purpura forbesi* Dunker, 1853, Luanda, Angola, ZMB, 34,7 mm ;
248. Busua, Ghana, RH, 50 mm.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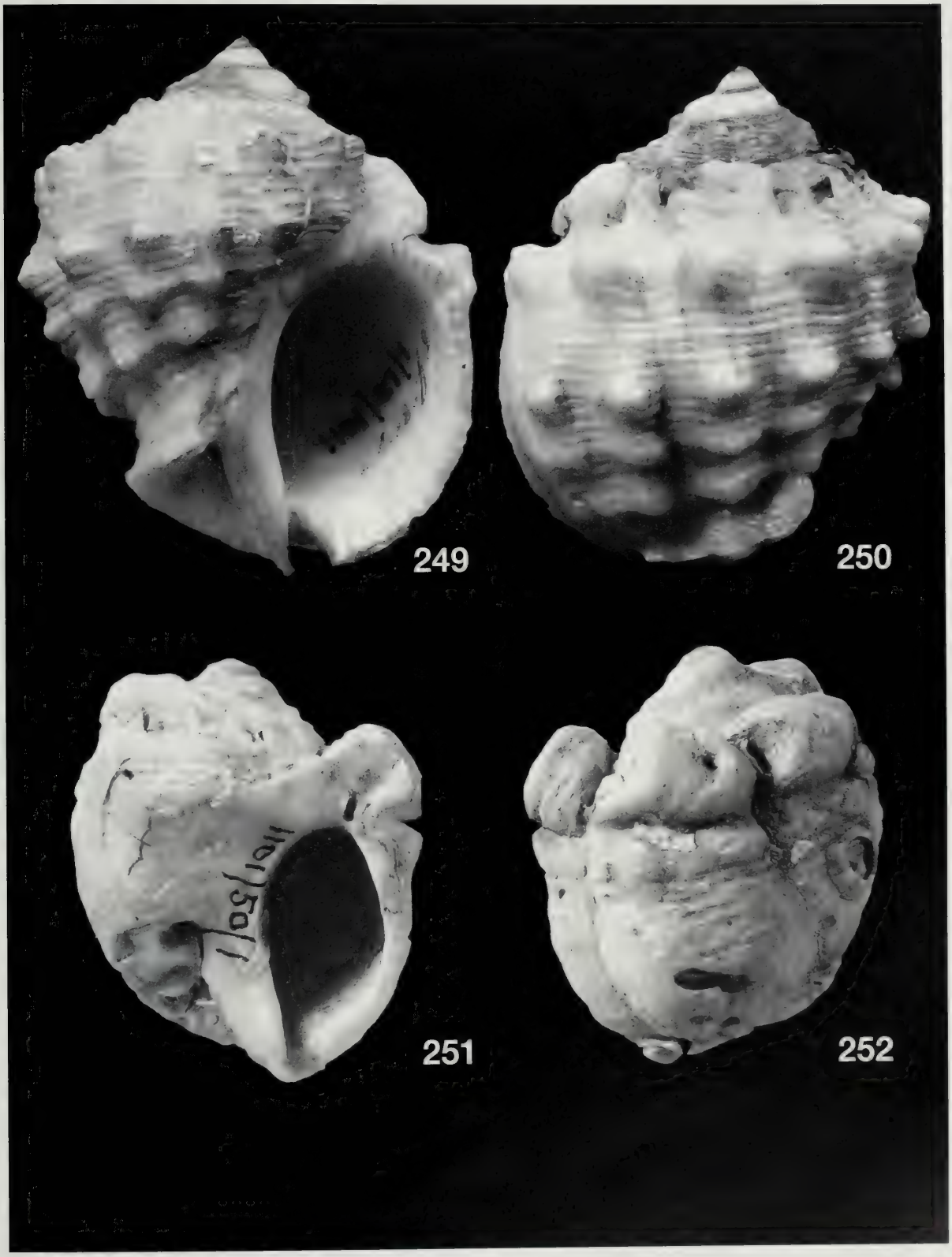
Figures 249-252.

249-250. *Thais (Thaisella) coronata* (Lamarck, 1816), syntype probable MHNG 1101/51/1, 45,5 mm, photo G. Dajoz.

251-252. *Thais (Thaisella) callifera* (Lamarck, 1816), syntype MHNG, 35 mm, photo G. Dajoz.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Figures 253-262.

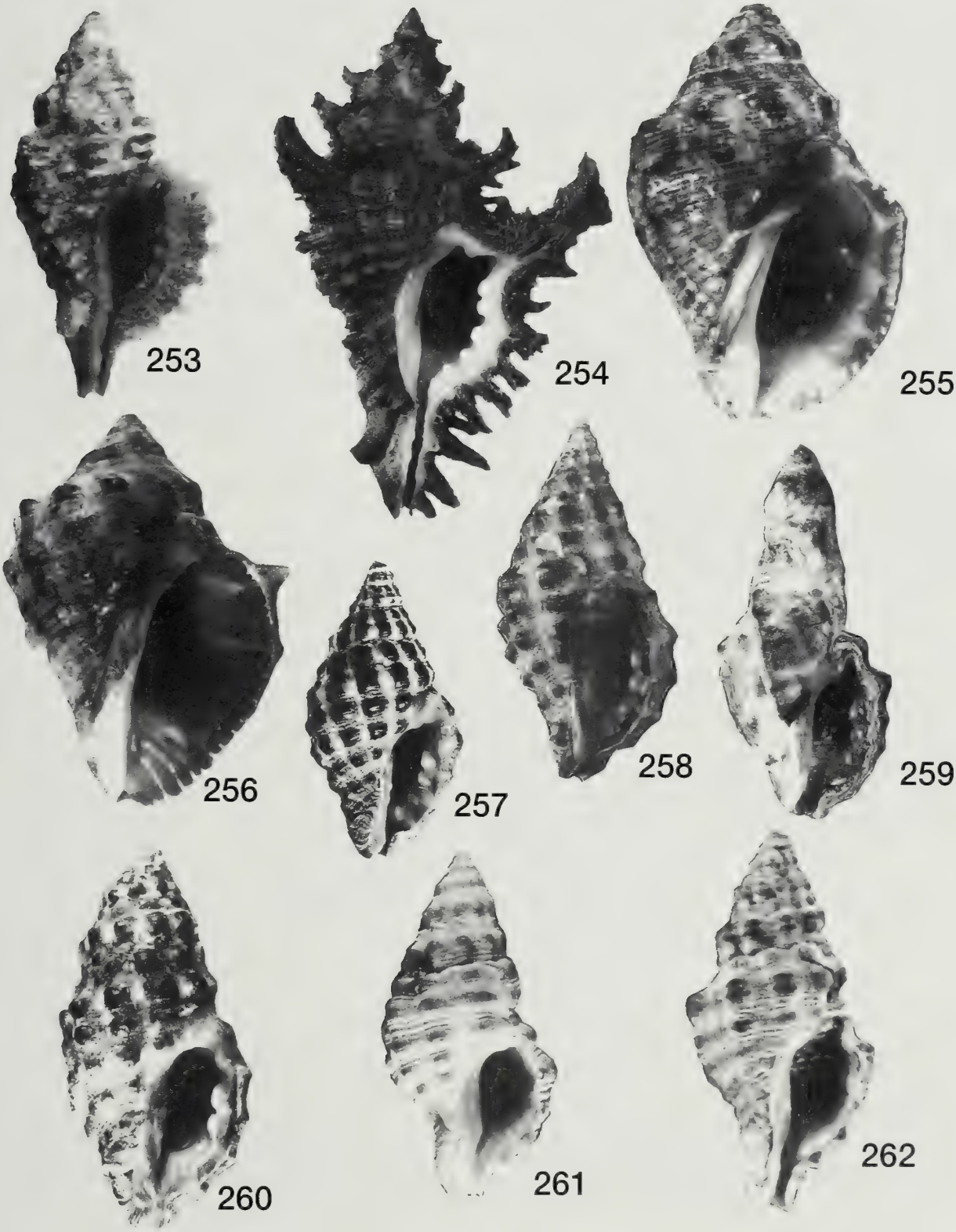
253. *Ocenebra isaacsi* Houart, 1984, Ghana, holotype IRSNB 26716/404, 10 mm.

254. *Chicocenebra gubbi* (Reeve, 1849), Gabon, RH, 49,1 mm.

255-256. *Stramonita bicarinata* (De Blainville, 1832) :
255. Syntype, Sainte Hélène, MNHN, 25 mm ;
256. Holotype de *Purpura helenae* Quoy & Gaimard, 1833, Sainte Hélène, MNHN, 22,5 mm.

257-260. *Morula nodulosa* (C.B. Adams, 1845) :
257. Jamaique, Lectotype MCZ 177045, 15,7 mm, photo E.H. Vokes ;
258. Gabon, MNHN, 17 mm ;
259. Cap Vert, RH, 21,1 mm ;
260. Syntype de *Ricinula ferruginosa* Reeve, 1846, BMNH 1968462, 18,8 mm.

261-262. *Morula consanguinea* (Smith, 1891), Sainte Hélène :
261. Lectotype BMNH 1899.10.1.2368, 17,4 mm;
262. MNHN, 13,8 mm.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Non-isometric growth and problems of species delimitation in the genus *Oliva* [1]

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KEYWORDS. Mollusca, Gastropoda, *Oliva*, taxonomy, non-isometric, growth.

ABSTRACT. The shape of the shell of some *Oliva* species undergoes abrupt changes during growth. If undetected, this often overlooked phenomenon can cause serious errors in the delimitation of morphospecies. Examples of non-isometric growth are reported and discussed.

RESUME. La forme de la coquille de quelques espèces d'*Oliva* subit des changements abrupts durant la croissance. La non-détection de ce phénomène, souvent négligé, peut entraîner des erreurs sérieuses dans la délimitation des morpho-espèces. Des exemples de croissance non-isométrique sont rapportés et discutés.

1. INTRODUCTION

All species of *Oliva* —like nearly all species of marine molluscs— have been described solely on the basis of morphological characters (mostly features of the shell). Other approaches, such as molecular genetics, might be preferable in theory but in practice the taxonomist deals nearly exclusively with morphospecies, resting upon the demonstration of morphological gaps. Such a demonstration is, of course, more objective if it rests upon quantitative characters.

Difficulties in taxonomic interpretation may arise for a variety of causes. For instance, species undergo morphological modifications over the course of time (this case, the *chronospecies* of the palaeontologist, will not be considered here). The delimitation of living species is fraught with other problems. Examples abound of animal species in which adults and juveniles, males and females and even different populations of a same species have very different morphological characteristics. So, it is important to keep in mind that morphological gaps do unambiguously demonstrate the existence of separate species only if three conditions (at least) are met:

a. The samples to be compared must be strictly sympatric. It is fully expected (see MAYR 1969 and FUTUYMA 1986) that different populations of a same species could be separated by a suitable combination of characters. This is very much the case in the genus *Oliva*, in which populations of a same species - even when separated by very short geographical distances - are often fully separable. Sympatry should then be reduced to syntopy (see TURSCH 1994, 1995).

In these conditions, what should one do with allopatric populations? The set of local populations of every *Oliva* species studied so far appears to form a morphological continuum, in which no population can be separated from *all* the others (for an example, see TURSCH & GREIFENEDER 1996). The solution is then to test the presence of morphological gaps not between populations but between sets of populations covering the whole distribution ranges (TURSCH 1995).

b.- The discriminating characters should not be sex-related. In the case of *Oliva*, no significant sexual dimorphism could be evidenced (HUART, unpublished observations) in the shells of dissected series of the rather unrelated species *O. tigrina* Lamarck, 1811 (from Madagascar), *O. amethystina* (Röding, 1798) and *O. oliva* (Linnaeus, 1758) (both from the Philippines). The only case of sexual dimorphism reported so far is a slightly differential growth for male and female Indian specimens of *O. oliva* and is restricted to very large specimens of over 39.5 mm (KASINATHAN, MARUTHAMUTHU & TAGORE, 1987). Recent work (KANTOR & TURSCH, unpublished) could not evidence any sexual dimorphism in the population

[1] This is paper 27 in the series *Studies on Olividae* and Laing Island Biological Station contribution n° 345.

of *O. oliva* (from Sisimangum Beach Hansa Bay, Papua New Guinea) that will be discussed here under.

c.- Separations should rest upon unbiased samples. In practice, it is often difficult to check if this obvious requirement is met. The field collector, especially when dealing with abundant species, is often inclined to collect only the most '*interesting*' specimens (extremes in the distribution of some attribute), neglecting the 'uninteresting' intermediates. Such biased samples are a frequent cause of taxonomic errors, because shells are generally not described by the same people who have collected them in the field. Authors are therefore often unaware of the collecting bias affecting the samples they study. For instance, a sample of *Oliva miniacea* (Röding, 1798) from Kwajalein Atoll, strongly biased for extremes in size, led to the description of the small specimens as a separate species, *O. berti* Terzer, 1986 (see TURSCH & GREIFENEDER 1996).

There is still an additional, often overlooked risk of errors: the growth pattern of many species undergoes rather abrupt changes. If this phenomenon is undetected, there is an obvious danger of splitting conspecific young and old specimens into separate, artificial "species" reflecting different, succesive patterns of growth.

The present paper draws attention to the problems raised by some *Oliva* species in which the shape of the shell is greatly modified during growth. It only aims at illustrating the existence of complex cases, not at their rigorous statistical analysis.

2. OBSERVATIONS and INTERPRETATION

2.1. The general case: isometric growth.

Massive experimental evidence (see, amongst others, TURSCH & GERMAIN 1985; VAN OSSELAER & TURSCH 1993a; VAN OSSELAER & TURSCH 1993b) has shown that most linear measurements on *Oliva* shells can be approximated as being in isometric relation. The relationship between any two teleoconch linear measurements X and Y can be generally approximated as being linear. A few examples, selected amongst many others, are given here. Fig. 1 illustrates the relation of **D** (the maximum diameter) and **H** (the total length) with the length of the lip, **L** (for a definition of these measurements, see TURSCH & GERMAIN 1985). Fig. 2 depicts the relation of **DN**, a measure of the width of the anterior notch (for definition, see VAN OSSELAER & TURSCH 1993a) with **L**. Fig. 3 shows the variation of the fasciolar zone measurements **PLI**, **UF** and **BW** (for definitions, see VAN OSSELAER & TURSCH 1993b) with **H**.

It can also be seen that, in all these examples, the intercept with the Y axis is negligible, the regression lines passing practically through the origin of the axes. This means that, in most cases, one can consider the ratios Y/X as constant for a given phenon. These ratios can therefore constitute reliable taxonomic discriminants.

It is important to be aware that the samples used for establishing the regression lines of Figs. 1, 2, 3 are strongly biased in order to represent all size classes. So, the frequency of sizes within the growth series is ***very*** different from that of natural populations.

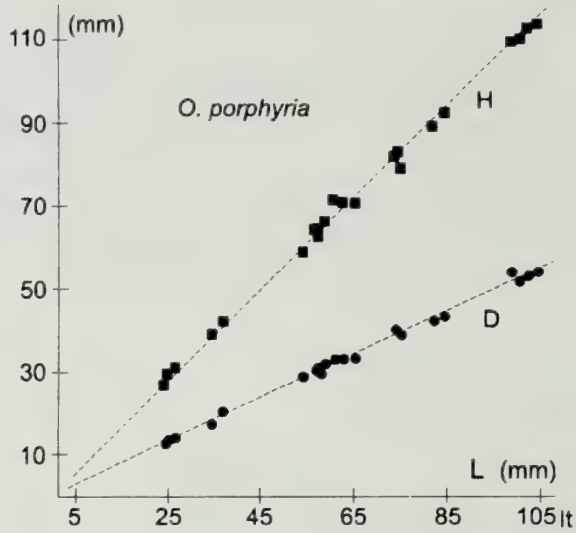

Fig. 1. Example of isometric growth. *Oliva porphyria*. Scatter diagram of teleoconch measurements H and D *vs.* shell size, expressed as the length of the shell, L.

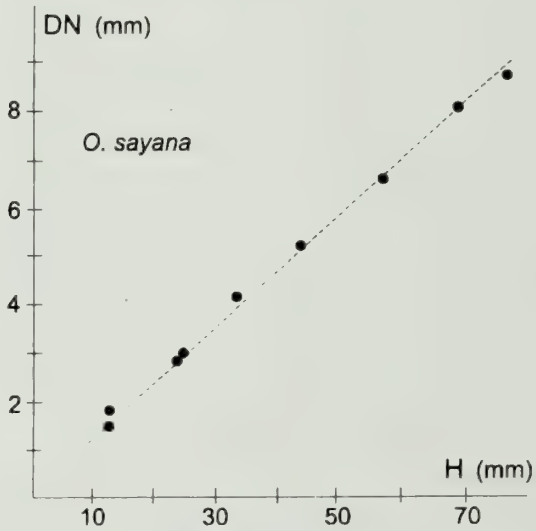

Fig. 2. Example of isometric growth. *Oliva sayana*. Scatter diagram of anterior notch measurement DN *vs.* shell size, expressed as the length of the shell, H.

Instead of reducing extensive variables to ratios of linear measurement (as in Figs. 1, 2, 3) to yield *descriptors of shape*, one could also use as internal

reference PNW (the number of postnuclear whorls) to yield *descriptors of growth*. Due to the helico-spiral growth of the shell, one cannot expect a linear teleoconch measurement *Y* to vary in a linear relation with PNW. As an example, specimens of a population of *O. rufula* Duclos, 1840 from Hansa Bay show a regular variation of D and H with PNW (see Fig. 4). As for most *Oliva* shells, the observed curvature is rather weak. Although the curve in Fig. 4 has an exponential aspect, this is not a case of allometric growth (because one is not comparing two linear measurements). With the possible exception of the slight sexual dimorphism reported for very large specimens in an Indian population of *O. oliva* (see § 1b), no case of strict allometry has been yet reported in *Oliva* shells.

This does not mean that the growth of *Oliva* shells is always isometric. In several species, the shape of the shell obviously varies during growth. Two different cases will be reported and discussed here.

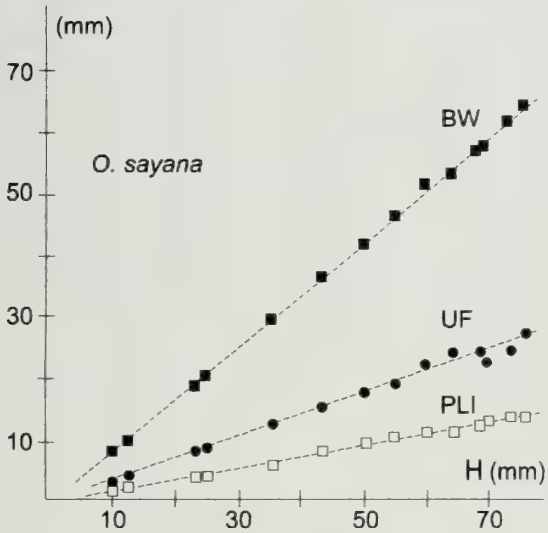

Fig. 3. Example of isometric growth. *Oliva sayana*. Scatter diagram of fasciolar zone measurements PLI, UF and BW *vs.* shell size, expressed as the length of the shell, H.

2.2. Non-isometry resulting from changes in lip angulation: *Oliva buelowi* Sowerby, 1889.

2.2.1. Data.

In the species *O. buelowi* Sowerby, 1889, the shapes of juvenile and "adult" shells are strikingly different. The shells undergo two consecutive shape transitions during their growth. A first modification in shape (and colour pattern) has been reported for very small shells (in the range 7.5-8.5 mm) by TURSCH, GERMAIN & GREIFENEDER (1986) and will not be re-discussed here.

The covariation of longitudinal measurements (all in the direction of the shell axis), such as **L**, **H** and **LW** (defined in TURSCH & GERMAIN 1985), is linear, just like in the "normal" example of Fig. 1. The same, except for a greater dispersion of experimental points (see Fig. 5), goes for radial measurements (all perpendicular to the shell axis), such as **D**, **X** and **R** (defined in TURSCH & GERMAIN 1985).

In sharp contrast, if one plots radial against longitudinal measurements, then the experimental curves exhibit strong deviations from linearity (see Fig. 6). An important change of shape (**D** and **X** measurements quite suddenly increase more than expected) takes place when the shell reaches a length (**H**) of very roughly 18 mm (about 60% of the maximum size). A diffuse transition zone between the two growth patterns starts at shell length of about 15 mm.

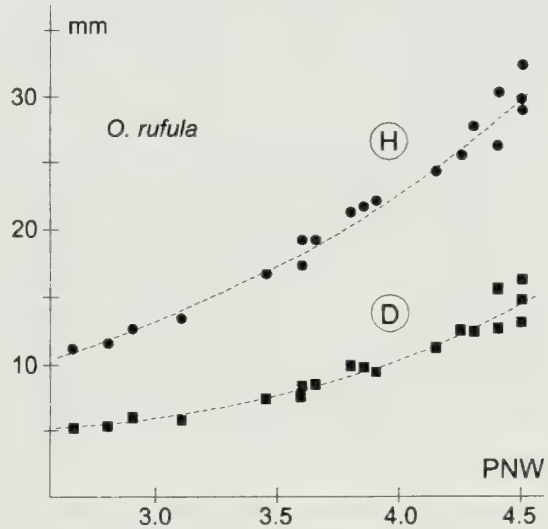

Fig. 4. *Oliva rufula*. Scatter diagram of H and D *vs.* PNW, the number of postnuclear whorls.

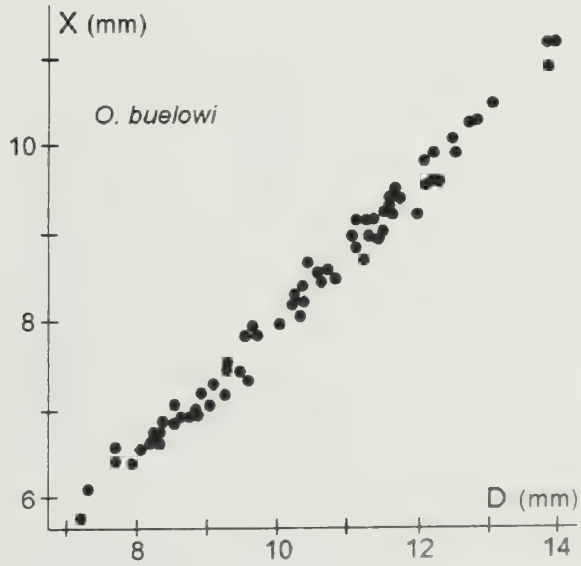

Fig. 5. *Oliva buelowi*. Scatter diagram of R *vs.* D.

3.2.2. Interpretation.

The curves of Fig. 6 cannot be explained by simple allometry, as this could not explain the peculiar, sigmoid-like aspect of the observed curves. The observed change in shape does not seem to be a case of abrupt change in the growth parameters of the generating spiral, as the spire of the shell appears to be quite regular. It is not an abnormality and it is not sex-related, as the phenomenon is observed for nearly all specimens of this population. It is also the norm in other populations (from the South coast of Papua New Guinea, from New Britain and from the Solomon Islands).

Large shells of *O. buelowi* (over 20 mm) have a very thick, angled, spiral thickening on the body whorl, whereas juveniles (under 15 mm) are completely regular, as sketched on Fig. 6. The change in shell shape does not always take place at *exactly* the same shell size. This explains why the points in the diagrams of Figs. 5 and 6 are much more scattered than usual (see Fig. 1).

What is the nature of the observed change in growth pattern? In the terms of the classical helico-spiral gastropod shell model (RAUP 1966) the observed facts can be explained by a delayed change in the shape of the generating curve (parameter ***S***). Such cases of delayed development of a character in ontogeny are considered to be a special case of heterochrony: *hypermorphosis* (see e.g. GOULD 1977, SHELDON, 1993). Other examples of shape changes during the development of gastropod shells have been reported, such as the case of fossil *Melanopsis* species (GEARY 1988).

3.3. Non-isometry resulting from changes in whorl expansion: *Oliva oliva* (Linnaeus, 1758).

3.3.1. Data.

Oliva oliva (Linnaeus, 1758) is one of the most protean species in the genus. The taxonomic problems raised by its extreme variability have been analysed by TURSCH, MISSA & BOUILLON (1992). The data reported here concern an intertidal population of *O. oliva* from Sisimangum Beach, Hansa Bay, Papua New Guinea. That particular population, probably the most intensively studied population in the whole genus, has previously been quantitatively monitored over nearly one year (TURSCH, OUIN & BOUILLON 1995).

The scatter diagram of diameter **D** *vs.* shell length **H** (see Fig. 7) has the usual, isometric appearance. In contrast, the scatter diagram of the lip length **L** *vs* **H** (see Fig. 7) shows a small, but definite deviation from linearity. The existence of an irregularity in the growth pattern becomes evident if one considers the scatter diagram of **D** and **L** *vs* the number of postnuclear whorls, **PNW** (see Fig. 8). One now clearly sees a discontinuity in the pattern of growth of **D** and especially of **H**. The corresponding changes in shell shape are sketched in Fig. 9.

Most individuals undergo a rather sudden increase of the length of the shell **H** (and of the maximum diameter **D**) at around 3.9 postnuclear whorls, corresponding to a shell length **H** of about 16-18 mm.

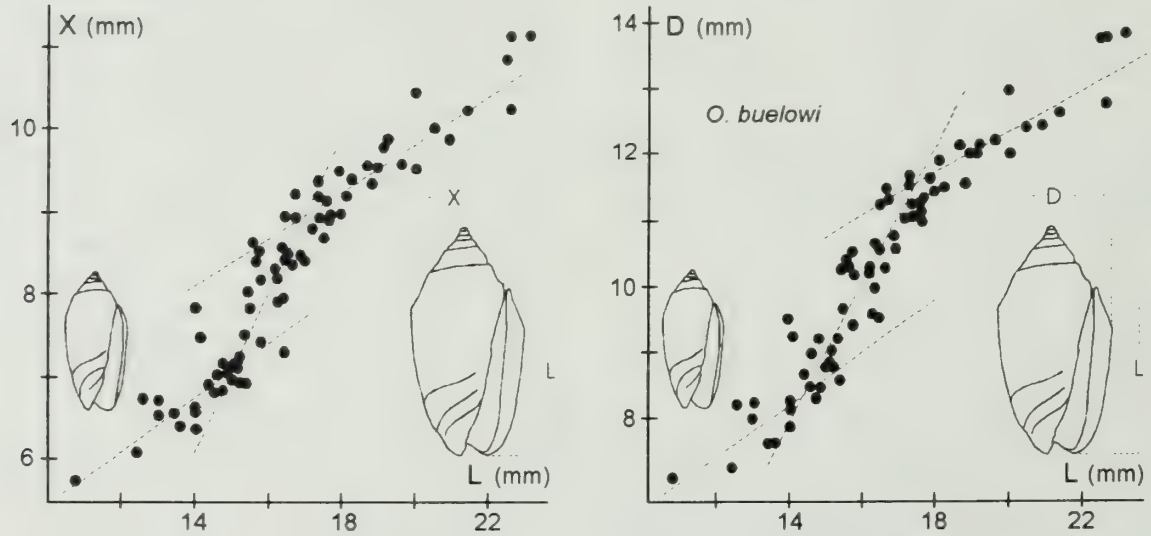

Fig. 6. *Oliva buelowi.* Scatter diagram of X (left) and D (right) *vs.* shell size, expressed as the length of the lip, L.

Some (much rarer) individuals continue along their initial growth trajectory for a while, the transition taking place before an observed maximum of 4.6 postnuclear volutions, corresponding to a shell length **H** of about 25-27 mm. Such individuals represent less than 1% in the well over 1000 specimens that were examined. Intermediate specimens, connecting the two successive growth patterns, are also very rare.

The change in growth pattern entails a change of **H** and **D**, as seen above. It also includes an abrupt change in the relative height of the spire, as evidenced by the scatter diagram of the spire height (**H-L**) *vs.* **H** (see Fig.10): a rather sudden decrease of (**H-L**) is followed by an apparently normal development. This decrease in the relative height of the spire can be explained by the observation, on large specimens, of a change in the inclination of the spire whorls, relative to the axis of the shell, as illustrated in the sketch of Fig. 11A. This results in a decrease of the rate of growth of the spire. The change generally occurs quite abruptly (see Fig. 11A) on about 0.05 whorl. This is not a case of allometric growth, which would result in a *progressive* change in slope, as depicted in the hypothetical example of Fig. 11B.

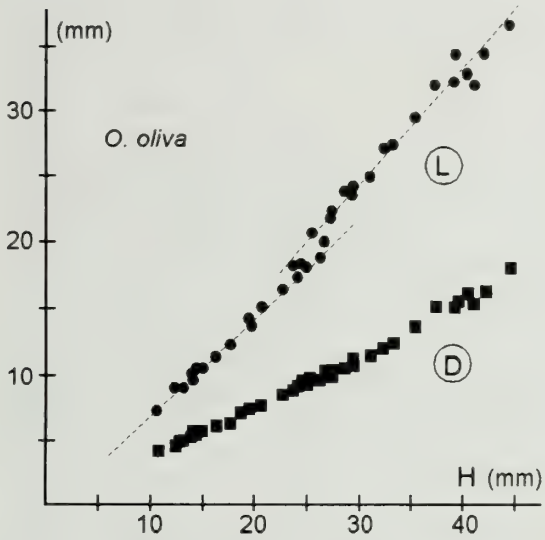

Fig. 7. *Oliva oliva* (growth series from Sisimangum Beach, Hansa Bay, PNG). Scatter diagram of D and L *vs.* H.

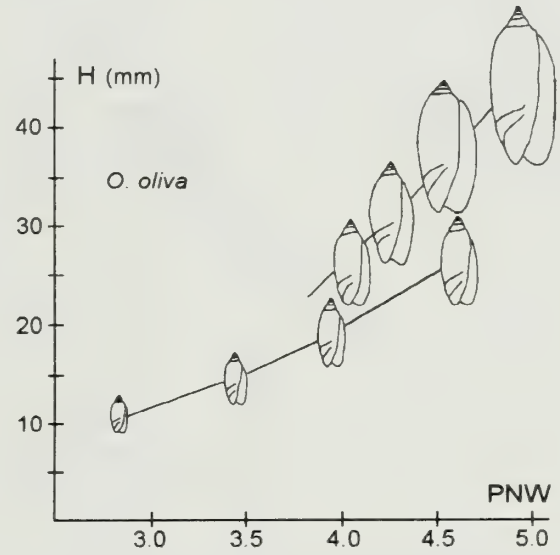

Fig. 9. *Oliva oliva* (growth series from Sisimangum Beach, Hansa Bay, PNG). Scatter diagram of H *vs.* PNW (shape of shells: note the variation of the position of the posterior notch).

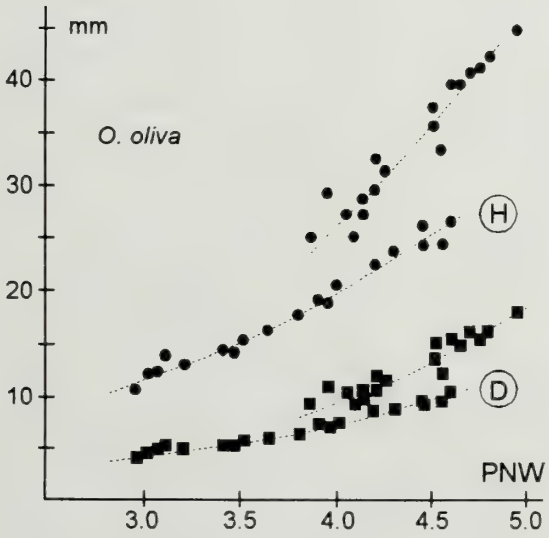

Fig. 8. *Oliva oliva* (growth series from Sisimangum Beach, Hansa Bay, PNG). Scatter diagram of D and H *vs.* PNW.

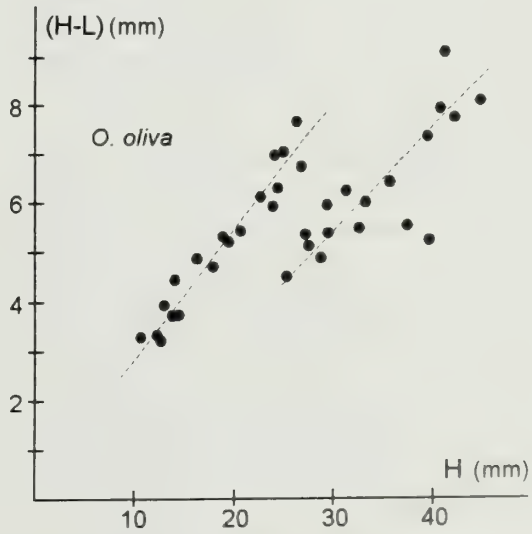

Fig. 10. *Oliva oliva* (growth series from Sisimangum Beach, Hansa Bay, PNG). Scatter diagram of the spire length (H-L) *vs.* H (see text).

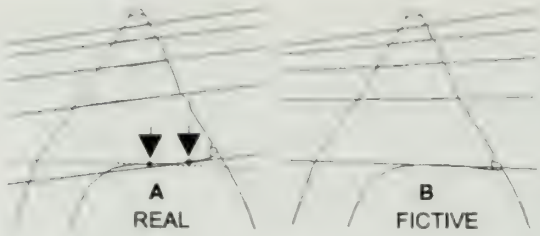

Fig. 11. *O. oliva*. **A**: Spire drawn to scale from actual specimen. The change in slope is abrupt and takes place over a small fraction of a whorl (indicated by arrows). **B**: Hypothetical example: change in slope due to allometric growth.

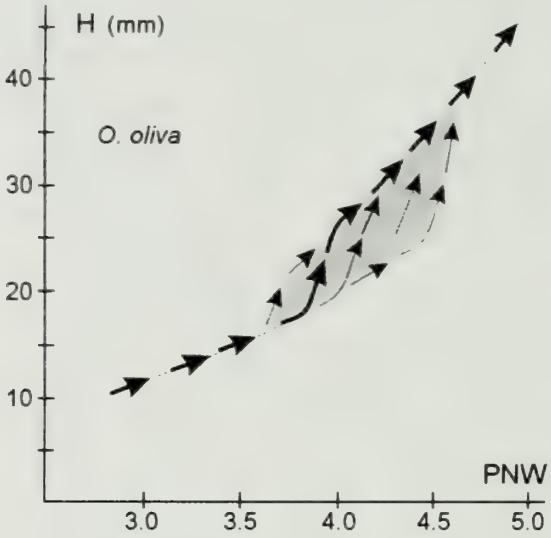

Fig. 12. *Oliva oliva* (Sisimangum Beach, Hansa Bay, PNG). Variation of H with PNW: inferred growth pattern of the population (see text).

3.3.2. Interpretation.
The general growth pattern of the population could be interpreted as in the sketch of Fig. 12. A change in shape does take place for all shells, but not *exactly* at the same time. Most specimens follow the path indicated by heavy arrows and only a few are found in the "transition zone" (shadowed).

The rarity of intermediate specimens (connecting the two successive growth patterns) could be fully expected. For a shell reaching 5 postnuclear volutions, the chance of finding a particular specimen in a given 0.05 whorl range (corresponding to the transition zone) would be about one in a hundred, if shell growth is continuous (we have no reasons to doubt this). In the case of this population, the real odds are certainly much smaller because most individuals die before reaching the size at which the change in growth pattern takes place (see TURSCH, OUIN & BOUILLON 1995).

What is the nature of the observed change in growth pattern? The best explanation appears to be another case of hypermorphosis, this time entailing a delayed, abrupt increase of *W* (the parameter of whorl expansion of RAUP 1966). This accounts for all the data, including the change in the inclination of the spire whorls.

4. DISCUSSION

Changes in lip outline. The phenomenon reported here above for *Oliva buelowi* has not caused taxonomic confusion, probably because the species was very rare in collections until recent years. In most other *Oliva* species in which adults have similar angulation at the lip [*O. incrassata* (Lightfoot in Solander, 1786), *O. parkinsoni* Prior, 1975; *O. mantichora* Duclos, 1840; *O. amethystina* (Röding, 1798), *O. peruviana* Lamarck, 1811], the phenomenon also had no taxonomic consequence, because lip angulation is already apparent in very small shells.

Changes in whorl expansion. Such cases are not rare. In several *Oliva* species, the rate of increase of the aperture becomes large enough to offset the effect of the rate of translation. Then the posterior tip of the outer lip as well as the parietal callus (on the columellar side) cease to move away from the apex during growth. In extreme cases, they can even raise above the channel of previous spire whorls, as for old specimens of *O. nigrita* (Karsten, 1789) (that case deals with a large number of nominal taxa and will be treated in a separate paper).

Such cases can lead to very serious errors in the taxonomic interpretation of morphological gaps. As an example, let us consider the sample of *O. oliva* (from Sisimangum Beach) considered here above in Fig. 10. A scatter diagram of **(H-L)/H** *vs.* **H/PNW** (see Fig. 13) yields two very clearly separated groups.

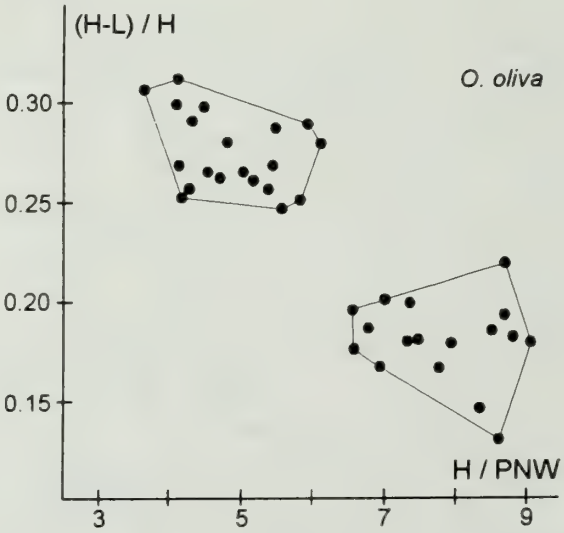

Fig. 13. *O. oliva*. (Sisimangum Beach, Hansa Bay, PNG, same specimens as Fig. 10). Scatter diagram of (H-L)/H *vs.* H/PNW. This is an example of misleading separation (see text).

Such a separation is as good as one can expect. The sample being not only sympatric but strictly syntopic, one has logically to conclude to the presence of two different species (the possibility of sexual dimorphism having been excluded, see Section 1, § b). This case is not fictional: the group with large **(H-L)/H** corresponds to *Oliva longispira* Bridgman, 1906, considered as a valid species in the revision of PETUCH & SARGENT, 1986.

The observed separation is very real, but the interpretation is entirely wrong. In fact, one has just separated two consecutive stages in the development of *O. oliva,* assuming that they are not linked by intergrades. It so happens that individuals at an intermediate degree between these two stages are very rare (see § 3.3.2). The possibility of taxonomic errors due to differential growth is further amplified if the samples are biased for size (a common occurrence, see § 1.4).

Precautions in taxonomic interpretation. In theory, one could simply skip the problems of differential growth by restricting comparative studies to adult specimens only. But this raises the practical problem: when is an *Oliva* shell adult? "Adult" could mean that the animal is sexually functional, but we have yet no way of inferring this from the shell. Then does "adult" mean that the animal has reached its full size? The presence of a thickened lip is commonly considered as indicating the end of growth, but this assumption is most probably wrong. It is not supported by the study of shell sections of growth series, showing that specimens way below the maximum size can already possess a thick lip (see TURSCH & MACHBAETE 1995). So, one does not know if a given specimen of *Oliva* has stopped growing or not. When one says that a specimen of *Oliva* is "adult", one generally means that it does not present obvious juvenile characteristics (amongst others: a much thinner shell and a sharp lip).

The presence of changes in the slope of the spire of large *Oliva* specimens should be taken as a strong warning of possible taxonomic problems due to non-isometric growth. In such cases, one should exert special caution when the nature of morphological gaps is related to absolute size. Data on juvenile shells should be interpreted with great caution and all efforts should be directed at obtaining complete, uninterrupted growth series. Analysis of colour patterns often yields the first clue that objectively separated samples are in fact conspecific. Strong indications of conspecificity can also be derived from size-invariant characters (*intensive variables*) such as the protoconch measurements and the angular measurements utilised for describing the anterior notch (see VAN OSSELAER & TURSCH 1993a).

Biological significance. Hypermorphosis by increase of the rate of expansion of the aperture takes place quite late in shell ontogeny as if, at a certain moment, the shell had to rapidly make room for a sharp increase in the volume of the soft parts. It is tempting to speculate that this corresponds to sexual maturity (*Oliva* would not be the only case of getting a big mouth at puberty). Recent observations (Y. KANTOR, unpublished) established that the Sisimangum population of *Oliva oliva* does indeed reach sexual maturity at a size of about 18-20 mm. A problem remains: the gonads are not located near the aperture but are housed much higher in the shell.

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REFERENCES

FUTUYMA, D.J. 1986. *Evolutionary Biology*. 2nd edition. Sinance Associates, Sunderland, Mass.

GEARY, D. 1988. Heterochrony in Gastropods. A paleontological view. pp. 183-196 in *Heterochrony in Evolution*, M. L. MC KENNEY, ed., Plenum Press, New York.

GOULD, S.J. 1977. *Ontogeny and Phylogeny*. Bellknap, Harvard.

KASINATHAN, K., S. MARUTHAMUTHU & J. TAGORE. 1987. Allometric relationships in *Oliva oliva* (Linné). *Indian J. of Fisheries* 34(2) : 208-213.

MAYR, E. 1969. *Principles of systematic zoology*. McGraw Hill, New York.

PETUCH, E.J. & D.M. SARGENT. 1986. *Atlas of the living Olive shells of the world*. 253 pp., CERF editions, Charlottesville, VA.

RAUP, D.M. 1966. Geometric analysis of shell coiling: general problem. *J. Paleont.* 40(5): 1190.

SHELDON, P. 1993. The evolution of form. In *Evolution: a biological and palaeontologcal approach*, P. SKELTON, Ed., Addison Wesley, Wokingham, England.

TURSCH, B. 1994. Studies on Olividae XXI. The scale of sympatry in the genus *Oliva*. *Apex* 9(4): 131-142.

TURSCH, B. 1995. Micro-endemism, allotopy and taxonomy in the genus *Oliva*. *Abstr. 12th Intl. Malac. Congr.*, Vigo: 107-109.

TURSCH, B., J.M. OUIN & J. BOUILLON. 1995. On the structure of a population of *Oliva oliva* (L., 1758) in Papua New Guinea (Studies on Olividae 22). *Apex* 10(2/3): 29-38.

TURSCH, B. & L. GERMAIN. 1985. Studies on Olividae. I. A morphometric approach to the *Oliva* problem. *Indo-Malayan Zoology* 1: 331-352.

TURSCH, B., L. GERMAIN & D. GREIFENEDER. 1986. Studies on Olividae. III. Description of a novel subspecies: *Oliva bulowi phuketensis*. *Apex* 1(3): 71-87.

TURSCH, B. & D. GREIFENEDER. 1996. The "*Oliva miniacea* complex", with the description of a familiar, unnamed species. (Studies on Olividae. 25). *Apex* 11(1): 1-49.

TURSCH, B. & Y. MACHBAETE. 1995. The microstructure of the shell in the genus *Oliva*. (Studies on Olividae. 24). *Apex* 10(2/3): 61-78.

TURSCH, B., O. MISSA & J. BOUILLON. 1992. Studies on Olividae XIV. The taxonomic structure of *Oliva oliva* (auct.). *Apex* 7(1): 3-22.

TURSCH, B., J.M. OUIN & J. BOUILLON. 1995. On the structure of a population of *Oliva oliva* (L., 1758) in Papua New Guinea (Studies on Olividae 22). *Apex* 10(2/3): 29-38.

VAN OSSELAER, C. & B. TURSCH. 1993a. Studies on Olividae. XV. Anterior notch measurements as taxonomic characters in the genus *Oliva*. *Apex* 8(1-2): 1-10.

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CORRECTIONS

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Figs 3-5. *Pterynotus laurae* n.sp., Philippine Islands, Sulu Sea. **3-4.** Holotype MNHN, 46.4 mm. **5.** Paratype coll. R. Houart, 45.5 mm.
Figs 6-7. *Pterynotus albobrunneus* Bertsch & D'Attilio, 1980. **6.** India, Trivirandum, coll. R. Houart, 44.6 mm. **7.** Seychelles, MNHN, 23.1 mm.

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Fig. 8. *Pterynotus pinnatus* (Swainson, 1822), Japan, coll. R. Houart, 57.2 mm.
Fig. 9. *Pterynotus pellucidus* (Reeve, 1845), Japan, coll. R. Houart, 54.3 mm.

Geographical distribution of *Pterynotus albobrunneus* and *Pterynotus laurae* n.sp.
▲ *P. albobrunneus* Bertsch & D'Attilio, 1980. ■ *P. laurae* n.sp.

Thermal effects on a medically important snail species *Lymnaea (Radix) acuminata* Lamarck (Gastropoda : Lymnaeidae)

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KEY WORDS. *Lymnaea (Radix) acuminata*, life-cycle, temperature, India (Calcutta).

ABSTRACT. The snails *Lymnaea (Radix) acuminata* are registered intermediate hosts of a number of helminth parasites causing worm-diseases in man and domestic animals in Indian sub-continent. Newly hatched (zero-day old) snails reared at 15°, 20° , 25° , 30° and 35° C (± 1°C), and room temperature (22.3-33.3°C) exhibited marked differences in their biological activities. At lower temperatures snails survived for a longer period (169-518 days) and produced maximum 80-93 eggs during a reproductive period of 223-246 days. At 25° and 30°C snails had shorter life spans of 128-145 days, and produced on average 37-56 eggs per individual. Individuals exposed to 35° C had an average life span of 17 days. None of them reproduced. Growth rate was higher at high temperatures. The average total body weight gained per week by an individual was 15.13, 8.97, 35.55, 34.02 and 17.29 mg at 15, 20, 25, 30 and 35°C respectively. At room temperature the snails survived on average for 110 days, gained 35.28 mg in body weight per week, started egg laying at the age of 62 days and produced 73 eggs per individual.

INTRODUCTION

Lymnaeids are very common in tropical and temperate countries (GODAN, 1983). They have drawn special attention of the malacologists because of their role in transmitting worm-diseases in man and animals (LISTON & SOPARKAR, 1918; RAO, 1933; CHATTERJEE, 1952; MALEK & CHENG, 1974; GHOSH & CHAUHAN, 1983; BURCH, 1985; RAUT, 1986). Since snail-borne diseases are a serious socio-economical threat in many countries, eradication of host-snails is urgently needed. As the parasitic worm passes its life cycle in two hosts, and the snails act as intermediate hosts it is assumed that the management of host-snail population would prove effective to control the snail-borne diseases. Accordingly, adequate attention has been paid by the workers to note the titbits of the snail-hosts under different ecological conditions (GODAN, 1983; JONG-BRINK, 1990; MOENS, 1991, 1992; POINTIER *et al.*, 1991; BRUCE & LIANG, 1992; RAUT *et al.*, 1992; LOKER *et al.*, 1993; SLOOTWEG *et al.*, 1993). The snails *Lymnaea (Radix) luteola* Lamarck and *L.(R.) acuminata* Lamarck are very important in respect to spread of worm-diseases in India and adjacent regions (GHOSH & CHAUHAN, 1975; RAUT, 1986; RAO, 1989). Much efforts are given to collect data on various aspects of biology of these snails in order to develop more efficient control measures. In the mean time, information on the influence of certain factors on the biology of *L.(R.) luteola* has been supplied by RAUT & NANDI (1985), RAUT & MISRA (1991, 1993), MISRA and RAUT (1993) and ROY & RAUT (1994). The present communication deals with the effects of temperature on the biology of *L. (R.) acuminata* occurring in and around Calcutta, India.

MATERIALS AND METHODS

Sixty-six healthy, sexually mature *L. (R.) acuminata* were collected from a pond located at Baghajatin, Calcutta on March 18, 1992. They were released into a plastic container 30 cm in diameter and 11 cm in depth, containing pond water, 8 cm in depth. Few specimens of *Chara, Vallisneria* and *Ipomea* were also released into the water of the container to provide resting and egg-laying sites for the snails. The snails were regularly supplied with mustard leaves as food. The snails started egg laying on the very next day. The egg capsules were collected on daily basis and kept in a glass beaker (500 ml capacity) containing pond water. The water in the containers was changed regularly with fresh pond water. Through regular observation newly hatched (zero-day old) snails were taken daily from the beakers. Depending upon the availability of the required number of snails the experiments were initiated. Newly hatched snails were placed in plastic containers (2 l capacity) containing pond water. The containers were kept in BOD (Biological Oxygen Demand) chambers and room conditions. The knobs of the BOD chambers were adjusted accordingly with a view to maintain the temperature of water of the

containers as desired. Thus, the snails were exposed to 15°, 20°, 25°, 30° and 35°C (±1°C) temperatures throughout. The room temperature was ranged from 22.3° - 33.3°C. For each temperature two containers, each with 30 newly hatched snail individuals were used. They were fed with mustard leaves throughout. A few specimens of *Chara, Vallisneria* and *Ipomea* were kept in water of the container to provide resting as well as egg laying support to the snails. Dead snails, faecal pellets and unconsumed food materials were removed every 24 hr., at the time of removal of water from each container.

Data on the life cycle parameters viz. the rates of growth in shell length, shell breadth and body weights; the age of sexual maturity, the length of reproduction period, post-reproduction period; the egg laying capacity, the hatching success of the eggs, the death rate and the longevity of the snails, were collected rgularly. Growth rates were studied by selecting 10 snails at random, 5 from each of the two containers exposed to a particular temperature. For other parameters, the mean was calculated on the basis of the data obtained. On way of calculations attention was given to testify the dependency of snail populations on temperature. SOKAL & ROHLF (1973) were followed to calculate Product-moment correlation coefficients. One-way ANOVA (Analysis of Variance) was applied for statistical interpretation of the data. Detailed comparisons of the data by way of ANOVA studies were made following CAMPBELL (1989).

RESULTS

At 15°, 20°, 25°, 30°C and room temperatures (22.3 - 33.3°C) the snails, *L. (R.) acuminata* thrived and reproduced though the rate of growth, age of sexual maturity, egg laying capacity, hatching success and the length of life of the snails varied with temperatures (Figures 1-5). At 35° C, 80% individuals died within 11 days, while the surviving specimens (one survived up to 164 days) were unhealthy and abnormal (as judged by seeing deshaped shell and sluggishness) throughout. These specimens did not reproduce in their life span. The ANOVA clearly indicates (Table 1) the significant effects of temperature on the life span ($P < 0.001$), rate of average gain in shell length ($P < 0.001$), shell breadth ($P < 0.001$) and body weight ($P < 0.001$), as well as on the time required for hatching of the eggs ($P < 0.001$) of *L. (R.) acuminata*. The results of correlation tests (Table 2) revealed that the rate of gain in shell length, shell breadth and body weight, the duration of post-reproduction period and the hatching success (%) of eggs have positive correlation with temperatures while the age of sexual maturity, the length of the reproduction period, the survival rate up to the age of sexual maturity, the number of egg capsules produced per individual, the length of life and the time required for hatching of eggs are negatively correlated with temperature. Also, in some cases such correlations are strongly influenced by certain biological parameters of the snail species under consideration (Table 2).

Temperature (° C)	Parameters				
	Longevity	Shell length	Shell breadth	Body weight	Hatching
Overall	229.12*	37.64*	18.49*	7.58*	2694.82*
A *vs* B	3.03[a]	0.05[a]	0.01[a]	1.67[a]	1246.19*
A *vs* C	66.41*	58.65*	35.85*	12.34*	5402.26*
A *vs* D	54.33*	92.46*	39.05*	8.30***	6677.25*
A *vs* E	559.21*	81.32*	33.38*	0.14[a]	7770.79*
A *vs* F	124.11*	23.65*	17.05*	8.45***	9429.75*
B *vs* C	99.80*	55.24*	36.86*	22.75*	1761.18*
B *vs* D	87.34*	88.64*	39.98*	15.99*	2393.66*
B *vs* E	790.29*	77.31*	34.36*	2.67[a]	2957.12*
B *vs* F	185.94*	21.85*	17.63*	15.69*	3818.79*
C *vs* D	1.47[a]	7.54***	0.82[a]	0.06[a]	17.18*
C *vs* E	94.59*	1.76[a]	0.04[a]	9.33***	52.14*
C *vs* F	1.52[a]	2.35[a]	0.77[a]	0.00[a]	115.66*
D *vs* E	154.60*	2.43[a]	1.18[a]	6.21**	9.57***
D *vs* F	7.55***	6.67**	2.54[a]	0.03[a]	43.87*
E *vs* F	119.02*	7.04**	0.50[a]	6.46**	12.26*

Significant at 0.1% (*), 0.5% (**) and 1% (***) level ; [a] : not significant. **A** : 15° C, **B** : 20° C, **C** : 25° C, **D** : 30° C, **E** : 35° C, **F** : room temperatures (22.3° - 33.3° C), ***vs*** means *versus*.

Table 1. Results (F-values) of ANOVA tests and detailed comparisons of the data by way of one-way ANOVA indicating the effects of temperature on certain life cycle parameters of *Lymnaea (Radix) acuminata*.

It is evident that the duration of reproduction period is shorter at higher temperatures (Figure 3) but snails exposed to such conditions become sexually mature at an earlier date (Figure 2). Likewise, lower temperatures allow snails to reproduce for a longer period. Accordingly, the interacting effects of these parameters could be visualised from Figures 1-5. The average length of post-reproduction period in snails was 14.5, 23.0, 52.0, 25.5 and 21.0 days at 15, 20, 25 and 30° C and room temperatures respectively.

The snails *L. (R.) acuminata* had the probability of production of eggs in both ways, through self-and cross-fertilization. It raises a question whether the data obtained on the size and frequency of egg clutches are statistically significant. To verify the same ANOVA tests were made and the results presented in Table 3. The snails exposed to room temperature (22.3 - 33.3°C) though were free from the effects of 20° C and 35°C temperatures had to face the influence of around 2°C temperature below 25° C and above 30° C.

Under such a situation whether the effect of room temperature was close to the mean effect of four constant temperatures viz. 20, 25, 30 and 35° C was testified through χ^2 studies. As the snails failed to rerproduce at 35° C, χ^2 was applied separately for the first (A to F) and last (G to L) six parameters (see Table 2). The results were significant at 1% level (for the first six parameters χ^2 = 30.28, for the last six parameters χ^2 = 12.88) in both the cases.

	T	A	B	C	D	E	F	G	H	I	J	K
A	-0.89 **											
B	-0.85 *	0.93 ***										
C	0.35	-0.38	-0.74									
D	-0.20	0.30	-0.53	-0.57								
E	-0.18	0.32	0.55	-0.63	0.99 ****							
F	-0.74	0.72	0.79	-0.42	0.78	0.74						
G	-0.90 **	0.94 ***	0.91 **	-0.50	0.17	0.18	0.65					
H	0.23	-0.05	0.05	0.12	0.70	0.62	0.64	-0.24				
I	-0.92 ***	0.99 ****	0.92 ***	-0.49	0.29	0.31	0.65	0.84	-0.37			
J	0.89 **	-0.87 *	-0.92 ***	0.50	-0.58	-0.56	-0.94 ***	-0.88 **	-0.15	-0.81 *		
K	0.86 *	-0.94 ***	-0.96 ***	0.55	-0.52	-0.52	-0.89 **	-0.93 ***	-0.07	-0.81 *	0.98 ****	
L	0.41	-0.98 ****	-0.93 ***	0.51	-0.45	-0.47	-0.79	-0.70	-0.18	-0.44	0.68	0.79

T : temperature. **A** : age of attainment of sexual maturity. **B** : length of reproduction period. **C** : length of post-reproduction period. **D** : individuals survived (%) up to the age of attainment of sexual maturity. **E** : number of egg capsules produced per individual. **F** : number of eggs produced per individual. **G** : time required for hatching of eggs. **H** : hatching success (%) of eggs. **I** : longevity. **J** : weekly gain in shell length. **K** : weekly gain in shell breadth. **L** : weekly gain in body weight.

Table 2. Results of correlation tests (r-values) between temperature and biological parameters of *Lymnaea (Radix) acuminata*. [* P < 0.05, ** P < 0.02, *** P< 0.01, **** P < 0.001].

Source of Variation	SS	df	MS	F	Remarks
Between Levels	23772.55	3	7924.18	11.09	Significant at 0.1% level
Residual	199388.58	279	714.65		
Total	223161.13	282			

Table 3. Results of ANOVA tests to justify the validity of the data obtained on the frequency and size of egg clutches of *L. (R.) acuminata* cultured at 15°, 20°, 25°, 30° and 35° C temperatures.

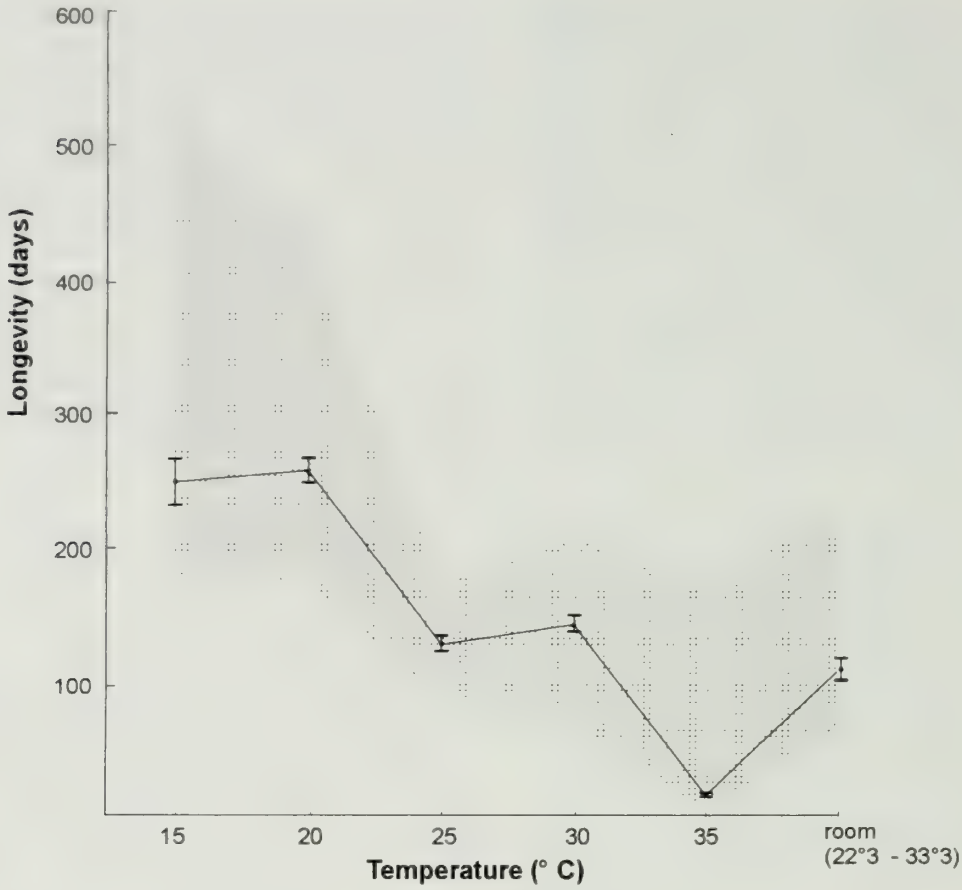

Fig. 1. Range (shadowed area) and mean (± s.e.) length of life of the snails *L. (R.) acuminata* cultured at different temperatures.

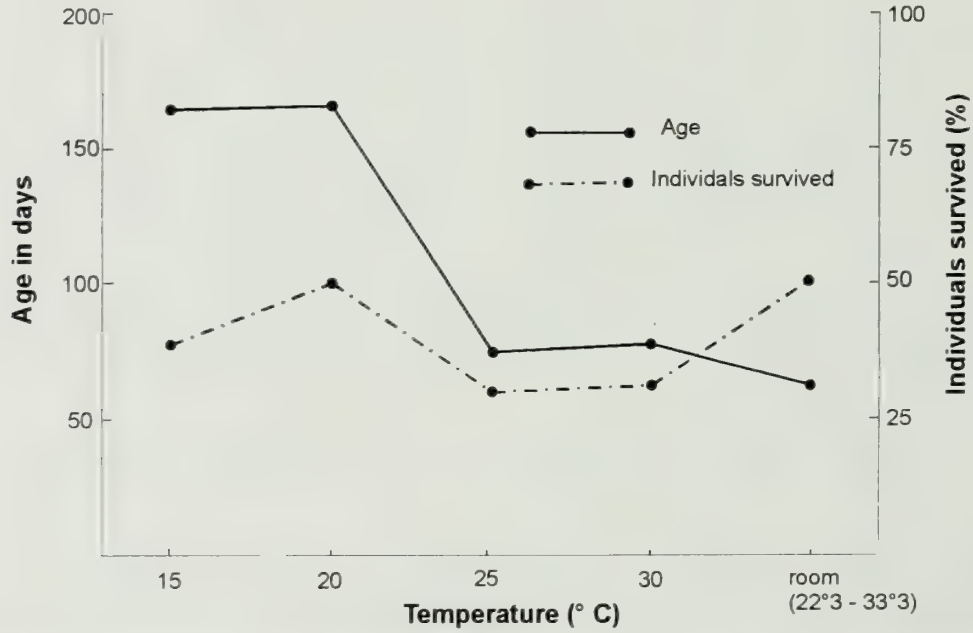

Fig. 2. The age of sexual maturity (as judged from the fact of deposition of first egg capsule by the snails of the batch concerned) and the percentage of individuals survived up to the age of attainment of sexual maturity when the snails *L. (R.) acuminata* were cultured at different temperatures.

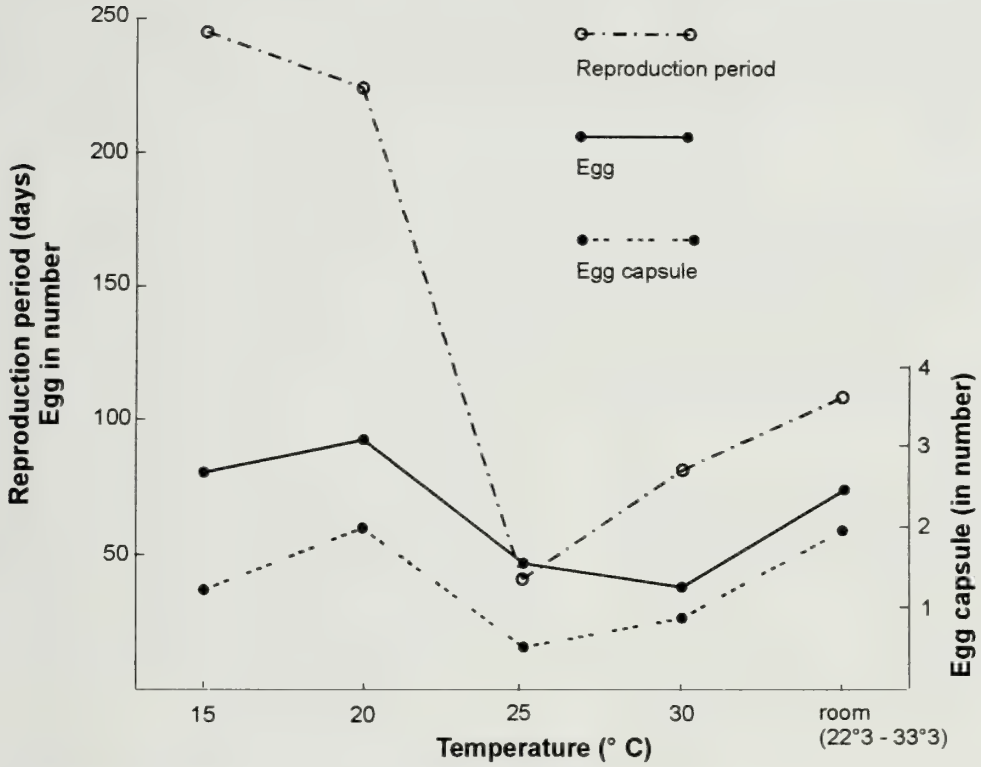

Fig. 3. The mean length of reproduction period and the number of egg capsules and eggs produced per individual when the snails *L. (R.) acuminata* were cultured at different temperatures.

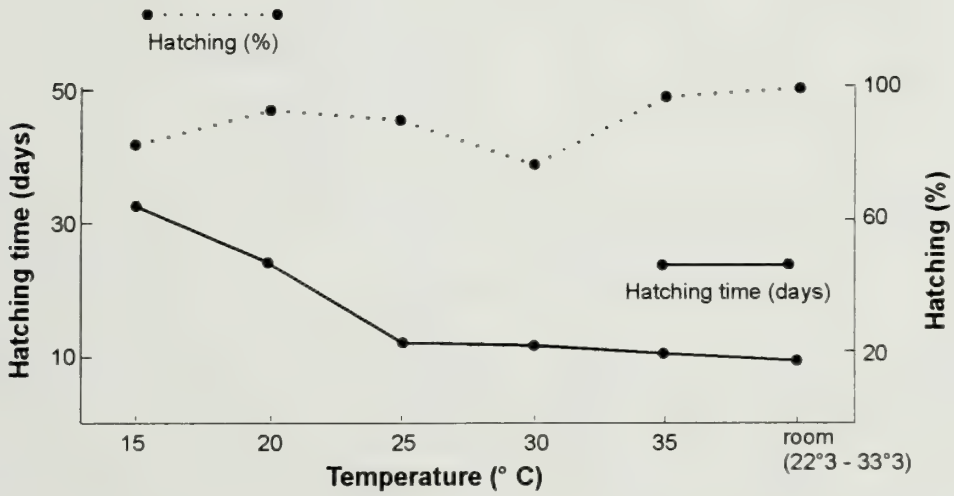

Fig. 4. The mean (error bars not shown because of very small) time required for hatching and the percentage of hatching of eggs of the snails *L. (R.) acuminata* when cultured at different temperatures.

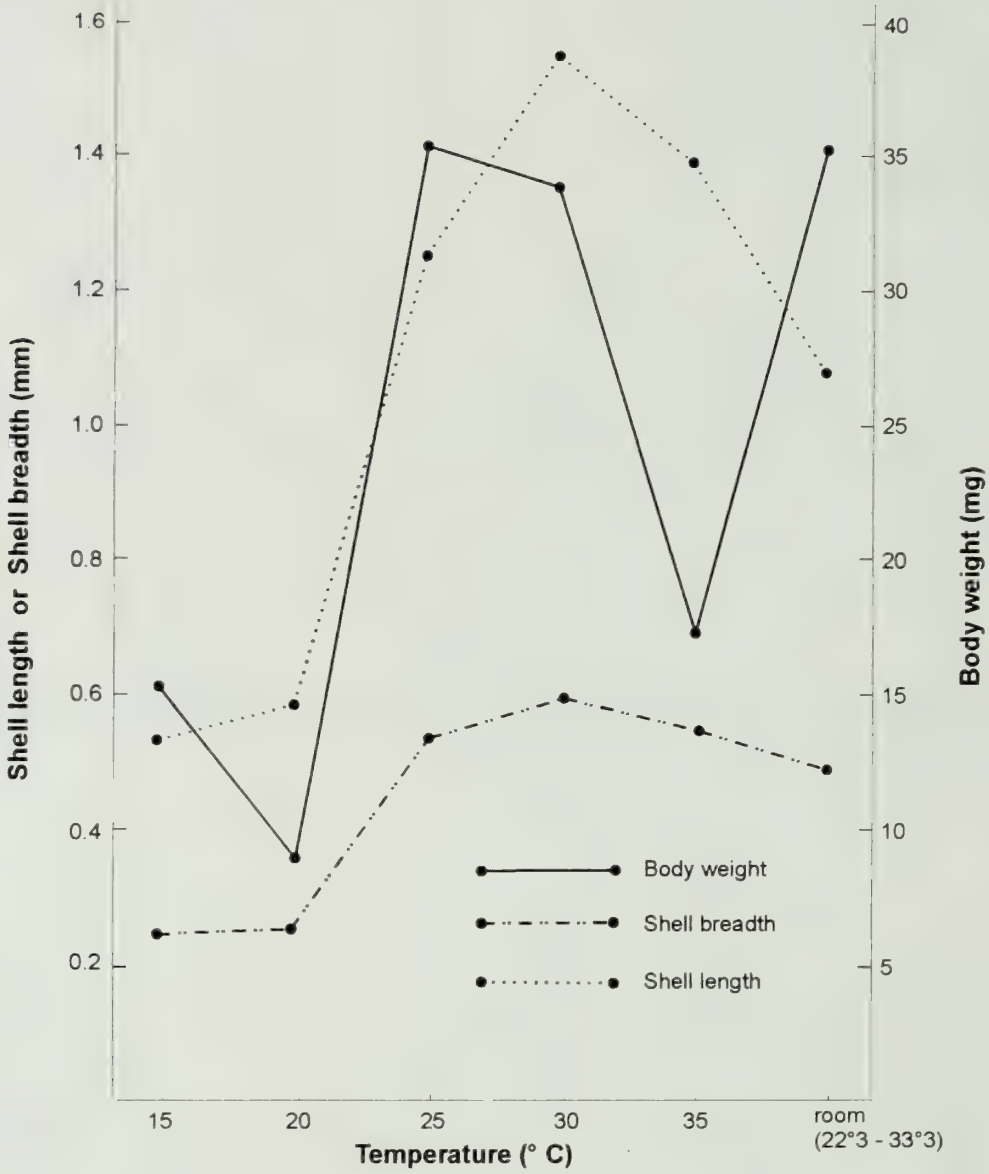

Fig. 5. Weekly average gain (error bars not shown because of very small) in shell length, shell breadth and tota body weight in *L. (R.) acuminata* cultured at different temperatures.

DISCUSSION

That temperature is a critical factor in the ecology of most organisms is well known (PRECHT *et al.*, 1973; MAGNUSON *et al.*, 1979; VIANEY-LIAUD, 1982; AHMED & RAUT, 1991; RAUT *et. al.*, 1992; AZIZ & RAUT, 1996). It is reported that the rate of growth, age of sexual maturity, length of reproduction period and egg laying capacity in snails *Lymnaea stagnalis* (VAUGHN, 1953), *Australorbis glabratus* (MICHELSON, 1961), *Bulinus (Physopsis) globosus* (SHIFF, 1964), *Biomphalaria pfeifferi* (STURROCK, 1966; APPLETON, 1977), *Biomphalaria glabrata* (CHERNIN, 1967; STURROCK & STURROCK, 1972; VIANEY-LIAUD, 1982), *Biomphalaria alexandrina* (EL-HASSAN, 1974), *Indoplanorbis exustus* (RAUT *et al.*, 1992) and *Lymnaea (Radix) luteola* (AZIZ & RAUT, 1996) fluctuate considerably within tolerable temperature ranges of the species concerned. Usually, low (15 - 20° C) temperatures delay the process of attainment of sexual maturity but enhance life span in tropical snails. Though, at such low temperatures the snails get a longer period for reproduction it is evident that the potentiality to produce eggs is reduced drastically as compared to the snails exposed to higher temperatures (RAUT *et al.*, 1992; AZIZ & RAUT, 1996). This phenomenon, as is evident from the results of present studies is also true for the snails *L. (R.) acuminata*.

The effect of temperature on the biology of *L. (R.) acuminata* is manifold because, a particular temperature acts differently on different biological parameters of an individual. Since a snail added on average 0.27, 0.39, 1.26 and 0.35 new individuals per day to the existing population of the species concerned while exposed to 15°, 20°, 25° and 30° C temperature respectively it can be said that density of *L. (R.) acuminata* is largely temperature dependent. As the recruitment rate is gradually higher with the increasing temperatures from 15° C to 25° C which is followed by a decline when the temperature was increased to 30° C, it is most likely that 25° C is ideal for maximum production. This suggests that the density of a snail population is largely temperature dependent, and thermal stimulus may act as influencing factor in regulation of population size.

Our results suggest that *L. (R.) acuminata* are highly sensitive to temperature differences as is evident from the data obtained on the rate of recruitment of new individuals at different temperatures. Though a particular temperature grade has a definite impact on the reproductive physiology of the snails under study the total mean effect of the fixed temperatures (20, 25 and 30° C) is almost equal to the effect noted for the snails exposed to room temperature. Because, the recruitment rates (0.67 at room temperature and 0.66 at fixed temperature) in these cases were almost equal. This suggests that the snails *L. (R.) acuminata* are apt to regulate the physiological process at par in respect to tolerable thermal conditions with a view to maintain the rate of reproduction at maximum level.

It appears that the snails *L. (R.) acuminata* are adapted to a wide range of temperatures and their population size would vary in different areas in respect to thermal conditions of the water bodies concerned.

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REFERENCES

AHMED, M. & S. K. RAUT. 1991. Influence of temperature on the growth of the pestiferous land snail *Achatina fulica* (Gastropoda : Achatinidae). *Walkerana* 5 : 33-62.

APPLETON, C. 1977. Review of literature on abiotic factors influencing the distribution and life cycles of bilharziasis intermediate host snails. *Malacol. Rev.* 11 : 1-125.

AZIZ, A.M. & S.K. RAUT. 1996. Thermal effect on the life-cycle parameters of the medically important freshwater snail species *Lymnaea (Radix) luteola* (Lamarck). *Mem. Inst. Oswaldo Cruz. Rio de Janeiro* 91 : 119-128.

BRUCE, J.I. & Y.S. LIANG. 1992. Cultivation of schistosomes and snails for researchers in the United States of America and other countries. *J. Med. & Appl. Malacol.* 4 : 13-30.

BURCH, J.B. 1985. *Handbook on schistosomiasis and other snail-mediated diseases in Jordon*. University of Michigan, Ann Arbor, Michigan, USA and Ministry of Health, Amman, Jordan. xv + 224 p.

CAMPBELL, R.C. 1989. *Statistics for biologists*, 3rd ed. Cambridge Univ. Press, Cambridge. XVII + 445p.

CHATTERJEE, K.D. 1952. *Human parasites and diseases*. The World Press Ltd., Calcutta. VI + 776 p.

CHERNIN, E. 1967. Behaviour of *Biomphalaria glabrata* and other snails in a thermal gradient. *J. Parasitol.* 53 : 1233-1240.

EL-HASSAN, A. 1974. Laboratory studies on the direct effect of temperature on *Bulinus truncatus* and *Biomphalaria alexandrina*, the snail intermediate hosts of schistosomes in Egypt. *Folia Parasitol. Czechol.* 21 : 181-187.

GHOSH, R.K. & B.S. CHAUHAN. 1975. Fifty years of faunistic survey in India. *Rec. Zool. Surv. Ind.* 68 : 367-381.

GODAN, D. 1983. *Pest slugs and snails*. Springer-Verlag, Berlin, Heidelberg, New York. VI + 445 p.

JONG-BRINK, M. DE. 1990. How trematode parasites interfere with reproduction of their intermediate hosts freshwater snails. *J. Med. & Appl. Malacol.* 2 : 101-133.

LISTON, W.G. & M.B. SOPARKAR. 1918. Bilharziasis among animals in India. The life-cycle of *Schistosomum spindalis*. *Ind. J. Med. Res.* 5 : 567-569.

LOKER, E.S., B.V. HOFKIN, G.M. MKOJI, B. MUNGAI, J. KIHARA & D.K. KOECH. 1993. Distributions of freshwater snails in southern Kenya with implications for the biological control of schistosomiasis and other snail-mediated parasites. *J. Med. & Appl. Malacol.* 5 : 1-20.

MAGNUSON, J.J., L.B. CROSDER & P.A. MEDVICK. 1979. Temperature as an ecological resource. *Amer. Zool.* 19 : 331-343.

MALEK, E.A. & T.C. CHENG, 1974. *Medical and Economic Malacology.* Academic Press, New York, London. 408 p.

MICHELSON, E.H. 1961. The effects of temperature on growth and reproduction of *Australorbis glabratus* in the laboratory. *Am. J. Hyg.* 73 : 66-74.

MISRA, T.K. & S.K. RAUT. 1993. Dynamic of population dynamics in a medically important snail species *Lymnaea (Radix) luteola* (Lamarck). *Mem. Inst. Oswaldo Cruz.* 88 : 469-485.

MOENS, R. 1991. Factors affecting *Lymnaea truncatula* populations and related control measures. *J. Med. & Appl. Malacol.* 3 : 73-84.

MOENS, R. 1992. Zones de prédation de *Lymnaea truncatula* par les zonitides. *J. Med. & Appl. Malacol.* 4 : 129-134.

POINTIER, J.P., M. FREDERIC & V. MAZILLE. 1991. Biological control of *Biomphalaria glabrata* by *Melanoides tuberculata* on Desirade Island, French West Indies. *J. Med. & Appl. Malacol.* 3 : 49-52.

PRECHT, H., J. CHRISTOPHERSON, H. HENSEL & A. LARCHER, 1973. *Temperature and life.* Springer-Verlag, Berlin, XI + 315 p.

RAO, M.A.N. 1933. A preliminary report on the successful infection with nasal schistosomiasis in experimental calves. *Ind. J. Vet. Sci. Anim. Husb.* 3 : 160-162.

RAO, N.V. SUBBA. 1989. *Handbook, Freshwater molluscs of India.* Zoological Survey of India, Calcutta. XXIII + 289 p.

RAUT, S.K. 1986. Snails and slugs in relation to human diseases. *Environ. and Ecol.* 4 : 130-137.

RAUT, S.K. & N.C. NANDI. 1985. The leech *Glossiphonia weberi*, in the control of the snail *Lymnaea luteola*, a predator-pray interaction. *Environ. and Ecol.* 3 : 21-24.

RAUT, S.K. & T.K. MISRA. 1991. Effect of salinity on the growth of three medically important snail species. *Bull. Malacol R.O.C.* 16 : 67-74.

RAUT, S.K. & T.K. MISRA. 1993. Influence of salinity on the breeding of three medically important fresh-water snail species (Gastropoda : Basommatophora : Lymnaeidae et Planorbidae). *Malacol. Abh. Mus. Tierkd. Dresden* 16 : 173-176.

RAUT, S.K., M.S. RAHMAN & S.K. SAMANTA. 1992. Influence of temperature on survival, growth and fecundity of the freshwater snail *Indoplanorbis exustus* (Deshayes). *Mem. Inst. Oswaldo Cruz* 87 : 15-19.

ROY, J.K. & S.K. RAUT. 1994. Factors influencing predation of the waterbugs *Sphaerodema annulatum* (Fab.) and *S. rusticum* (Fab.) on the disease transmitting snail *Lymnaea (Radix) luteola* (Lamarck). *Mem. Inst. Oswaldo Cruz Rio De Janeiro* 89 : 11-20.

SHIFF, C.J. 1964. Studies on *Bulinus (Physopsis) globosus* in Rhodesia. II. Factors influencing the relationship between age and growth. *Ann. Trop. Med. & Parasitol.* 58 : 106-115.

SLOOTWEG, R., E. VAN RHIJN, J.A. VAN SCHIJNDEL, M.J. DIJKSTRA, A.C. COLENBRANDER & S. KITMO. 1993. A longitudinal study of snail intermediate hosts of trematode parasites in the Benue Valley of north Cameroon. *J. Med. & Appl. Malacol.* 5 : 45-59.

SOKAL, R.R. & F.J. ROHLF. 1973. *Introduction to biostatistics.* W.H. Freeman and Co., San Francisco. 368 p.

STURROCK, R.F. 1966. The influence of temperature on the biology of *Biomphalaria pfeifferi* (Krauss), an intermediate host of *Schistosoma mansoni*. *Ann. Trop. Med. & Parasitol.* 60 : 100-105.

STURROCK, R.F. & B.A. STURROCK. 1972. The influence of temperature on the biology of *Biomphalaria glabrata* (Say), intermediate host of *Schistosoma mansoni* in St. Lucia, West Indies. *Ann. Trop. Med. & Parasitol.* 66 : 385-390.

VAUGHN, CH. M. 1953. Effect of temperature on hatching and growth of *Lymnaea stagnalis appressa* Say. *Amer. Midland Naturalist* 49 : 214-228.

VIANEY-LIAUD, M. 1982. Effets des hautes températures sur la reproduction de *Biomphalaria glabrata* (Mollusca : Basommatophora). (Proc. 7th Intern. Malacol. Congr.), *Malacologia* 22 : 159-165.

Description of a new species of Volutidae (Gastropoda) from Southern Australia

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KEYWORDS. Gastropoda, Volutidae, S. W Australia, *Paramoria jonhnclarki* sp. nov.

ABSTRACT. *Paramoria johnclarki,* sp. nov. is described. It is compared with the sympatric and congener *Paramoria guntheri* (E. A. Smith, 1886).

INTRODUCTION

Areas explored by scuba divers in the accessible places along the southern and western Australian shore as been restricted for a long time to the sponge zone, biotope of Cypraeidae, Genus *Zoila*. Recent extension of the diving exploration to sandy areas, up to now neglected, has allowed the study of volute populations that thrive there, particularly populations of *Paramoria guntheri*, rare until then, and to identify a new congeneric species sharing the same biotope.

These two species differ by stable features within homogeneous populations without intermediate specimens.

Abbreviations

AMS: The Australian Museum, Sydney, Australia.

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

WAM: Western Australian Museum, Perth, Australia.

FAMILY: VOLUTIDAE

SUBFAMILY: CYMBIOLINAE Bondarev 1995

GENUS: *Paramoria* McMichael 1960

Paramoria johnclarki sp. nov.

Figs 1-11, 20, 22

Type Material.

Holotype: WAM 113-95. West Australian Museum, Perth, W. Australia, 41.5 mm x 17 mm, live taken.
Paratype 1: Limpus coll., 46.8 mm x 19.3 mm, dead collected.
Paratype 2: MNHN, 39 mm x 17 mm, dead collected.
Paratype 3: Clark coll., 41.2 mm x 17.8 mm, live taken.
Paratype 4: Clark coll., 36.8 mm x 17.8 mm, broken specimen.
Paratype 5: Dixon coll., 43.4 mm x 17.9 mm, live taken.
Paratype 6: Dixon coll., 42 mm x 18.4 mm, dead collected.
Paratype 7: AMS n° C325301, 40.3 mm x 17.6 mm, dead collected.
Paratype 8: Museum of Victoria n° F.81094, 42.5 mm x 17.6 mm, dead collected.
Paratype 9: Bail coll., 38 mm x 16.4 mm, dead collected.
Paratype 10: South Australian Museum n° C 18985, 42.8 mm x 18.5 mm, dead collected.
Paratype 11: Limpus coll., 38.6 mm x 16.6 mm, dead collected.
Paratype 12: Limpus coll., 36.6 mm x 16 mm, dead collected.
Paratype 13: AMS n° C325301, 41.4 mm x 18 mm, dead collected.
Paratype 14: WAM n° 95-95, 41.2 mm x 17.6 mm, dead collected.
Paratype 15: Clarkson coll., 39.9 mm x 18.8 mm, dead collected.

Type Locality.

W. Australia, S.W. of Esperance, Archipelago of the Recherche, 35m, on sandy bottom.

Other Localities.

Paratype 1, from between Caiguna and Eucla, Great Australian Bight.

Paratype 15, from Taylors Island, Thorney Passage, S. Australia.

All other paratypes are from the Archipelago of The Recherche, S-E of Esperance, W. Australia.

Habitat.

Paramoria johnclarki is taken by scuba divers in 35 m on limestone rubble, weed sponge and sand, from the Archipelago of The Recherche, south coast of West-Australia. One specimen has been trawled in 120 m, between Caiguna and Eucla, Great Australian Bight ; two specimens taken by scuba divers in 25 m west of Taylors Island, Thorney Passage, south of Port-Lincoln, South-Australia ; and one specimen dredged in 150 m off Rottnest Island, West-Australia, by the research vessel DIAMANTINA in 1970. These four areas are remote from each other but embrace the same wide range as *Paramoria guntheri* from South - Australia (Port McDonnell) to West-Australia (Cap Naturaliste) (Fig. 1).

Description.

Shell medium sized (average length: 42 mm), solid, fusiform with back part expanded. Protoconch papilliform, slighty flattened, of 3 1/4 whorls with a white spiral sutural band becoming brown on teleoconch. Three adult whorls with short spire, the last two whorls bearing numerous attenuated knobs (Average 12 on last whorl), limiting a slighty concave subsutural zone. Aperture white, narrow, forming 80% of total shell length. Outer lip thickened and simple. Columellar lip straight with five columellar plaits: Four anterior plaits strong, oblique; posterior fifth only visible by a callosity forming a flattened convexity just behind 4th posterior plait. Inside the shell, this callosity becomes a weak but distinct plait. Siphonal notch narrow, shallow. Fasciole strong. Base colour creamy-white, ornamented with numerous (average 18) slighty wavy brown axial lines, angled and merging in the middle of the body whorl, crossed by two strong spiral bands. Posterior band permanently equal to or stronger than anterior band.

Discussion.

P. johnclarki sp. nov., sympatric whith *Paramoria guntheri*, is separable by the constant features presented in Table 1.

These five characteristics of differentiation are stable and always constant. Unlike *Paramoria guntheri*, *Paramoria johnclarki* shows no noticeable variation. The two species seem to share the same ecological niche (i. e. not visible during the inevitably brief time let to scuba divers at these depths)

This close morphological relationship can pose an hypothesis of gradual divergent evolution of a primary sibling species (twin species).

The *P. johnclarki* range in small scattered areas can be interpreted either as insufficient exploration or as a less competitive species, now reduced in relic areas. As a matter of fact, Paleontologic data seems in opposition with the concept of sibling species origine. According to DARRAGH (1988), *P. guntheri* could be direct evolution of a late Oligocene species: *Paramoria strophodon* (McCoy, 1876), and so he relegate *P. guntheri* to a subspecies in the name of *Paramoria strophodon guntheri*. However morphological concordance does not appears evidentiary to the present authors.

On the other hand, *P. johnclarki* can be compared with another Tertiary species: *Paramoria lundeliusae* Ludbrook, 1978. But this shell has neither a fifth columellar plait nor nodulose shoulders, that can make direct conspecificity very dubious. Even if Paleontology does not produce evident conclusion, we must point out how important was the specific diversification of the genus during the late Oligocene.

Supraspecific consideration.

P. johnclarki and *P. guntheri* are morphologically close to species of the genus *Amoria* Gray, 1855 : Papilliform multispiral protoconch with a light sutural line, four main columellar plaits, glossy surface. All these features are of *Amoria* type. Anatomy is similar with a Y-shaped radula.

Only the existence of knobs or spines on the shoulder is a separable feature. This closeness encouraged MCMICHAEL (1960) to separate *P. guntheri* from the genus *Nannamoria* Iredale 1929, in which it was linked by COTTON (1949).

	P. johnclarki	***P. guntheri***
Protoconch:	Dome-shaped, flattened	Dome-shaped, rounded
Shape:	Elongate fusiform, narrow aperture	Large, triangular, broad aperture
Plaits:	5	4
Pattern:	Stable. Axial lines hardly undulated. Posterior spiral band always equal to or stronger than the anterior band.	Variable. Axial lines hightly undulated. Posterior spiral bands rarely equal to but regularly weaker than the anterior band.
Animal colour:	Thin and regular orange, reticulation on cream background .	Thicker and more irregular reticulation on cream background.

Table 1. Features distinguishing *P. johnclarki* from *P. guntheri*

MCMICHAEL (1960) created the genus *Paramoria* for this species and for several different Tertiary fossils. The genus *Nannamoria*, morphologically close, contains several small species of eastern Australia, which feature dense axial lines, numerous and irregular columellar plaits, and radula with tricuspid rachidian tooth.

DARRAGH (1988) synonymized again these two genera, argueing the fact that several fossils do not allow a clear separation of the two, and denying radula as generic criterion for differentiation. WILLAN (1995), when describing a new species, *Nannamoria ranya*, considers the genus *Nannamoria* as an homogeneous group (including *N. amicula* Iredale 1929, *N. gotoi* Poppe 1992, *N. inopinata* Darragh 1979, *N. parabola* Garrard 1960), clearly separate from the taxon *guntheri* (E. A. Smith 1886). He restores the genus *Paramoria* for it on the basis of columellar plaits and radula differences

Though columellar plaits are often variable in several species of *Amoria*, and though the radula is an organ in direct contact with the environment and subject to strong evolutionary pressure that can produce rapid variations within the same genus, we provisionally adopt Willan's opinion and place his new species in the genus *Paramoria* which includes now three species: *P. guntheri* (E. A. Smith 1886), *P. johnclarki* sp. nov., and *P. weaveri* McMichael 1961.

Etymology.

This species is named in honour of John Clark of Esperance, West Australia, who first brought to our attention the existence of this previously unrecorded species, and who has worked tirelessly to obtain specimens for our study.

ACKNOWLEDGEMENTS. We are most grateful for the assistance given through information and specimens supplied by our other diving friends Peter Clarkson and Doug Dixon, without which our task would have been impossible to complete.

REFERENCES

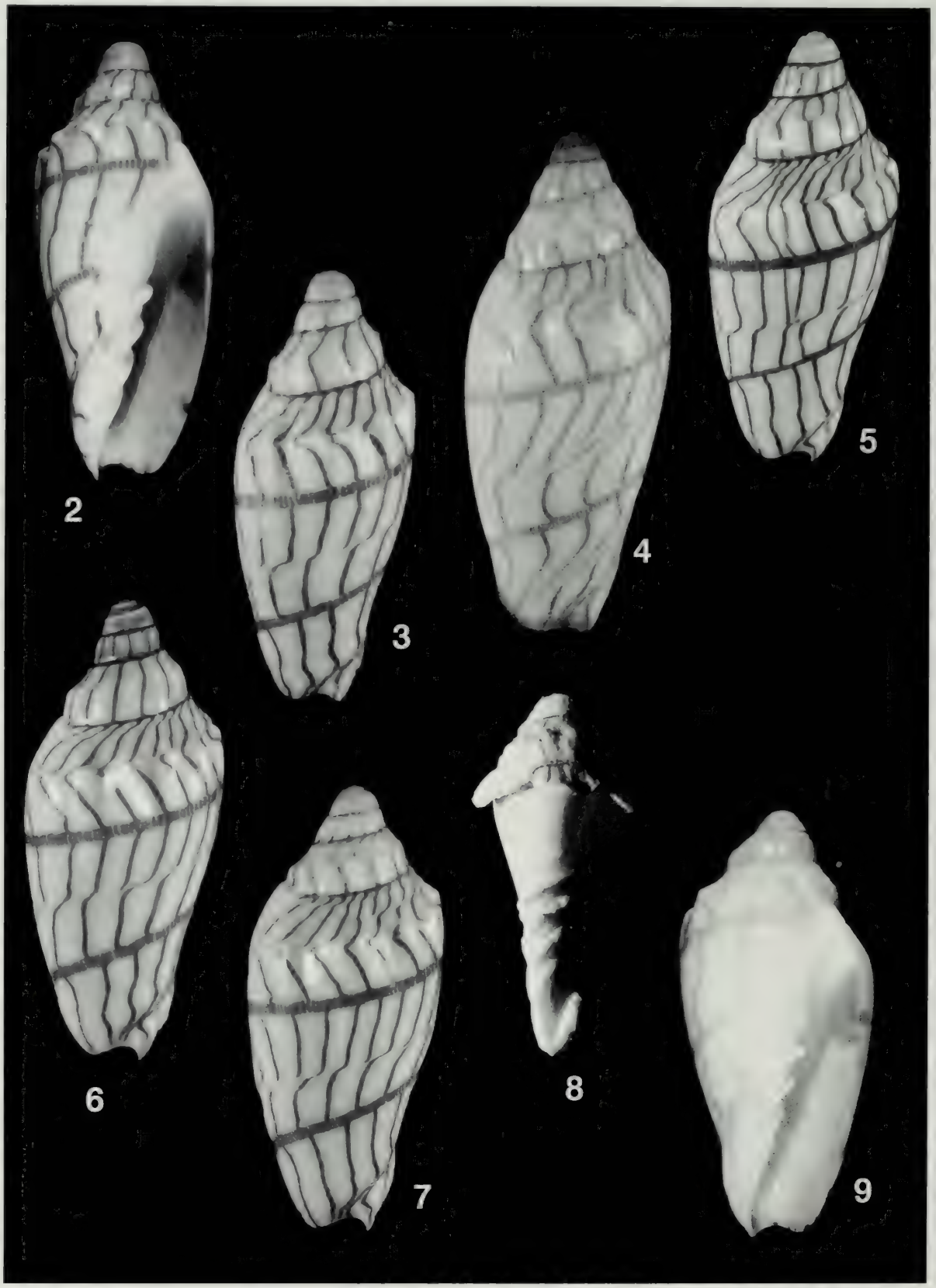
COTTON, B.C. 1949. Australian Recent and Tertiary Mollusca, Family Volutidae of S.E. Australia. *Rec.South Austr.Museum* 9(2) : 181-196.

DARRAGH, T.A. 1988. A Revision of the tertiary Volutidae of S. E. Australia. *Memoirs Mus. Victoria* 49(2) : 195-307.

MCMICHAEL, D.F. 1960. Notes on some Australian Volutidae. *J. Malac. Austr.* 4 : 4-13.

WILLAN, R.C. 1995. Taxonomic and biogeographic review of the Australian genus *Nannamoria* (Gastropoda: Volutidae) with the description of a new bathyal species. *Invert. Taxon.* 9 : 107-113.

Fig. 1. Distribution of *Paramoria johnclarki* sp. nov. and *P. guntheri* (E.A. Smith, 1886).
✸ *P. johnclarki*; ↔ *P. guntheri*.



Figs. 2-3. *Paramoria johnclarki* sp. nov. Holotype, 41.5 mm x 17 mm. WAM. 94-95. **Fig. 4.** *Paramoria johnclarki* sp. nov. Paratype 1, 46.8 mm x 19.3 mm. Limpus coll. **Fig. 5.** *Paramoria johnclarki* sp. nov. Paratype 3, 41.2 mm x 1 7.8 mm. Clark coll. **Fig. 6.** *Paramoria johnclarki* sp. nov. Paratype 5, 43.4 mm x 17.9 mm. Dixon coll. **Fig. 7.** *Paramoria johnclarki* sp. nov. Paratype 6, 42 mm x 18.4 mm. Dixon coll. **Fig. 8.** *Paramoria johnclarki* sp. nov. Columellar lip, showing 4 strong plaits and the fifth weak plait ending in a callous. **Fig. 9.** *Paramoria johnclarki* sp. nov. Paratype 15, ventral side showing the convex callous area just behind the fourth plait, origine of the fifth plait.

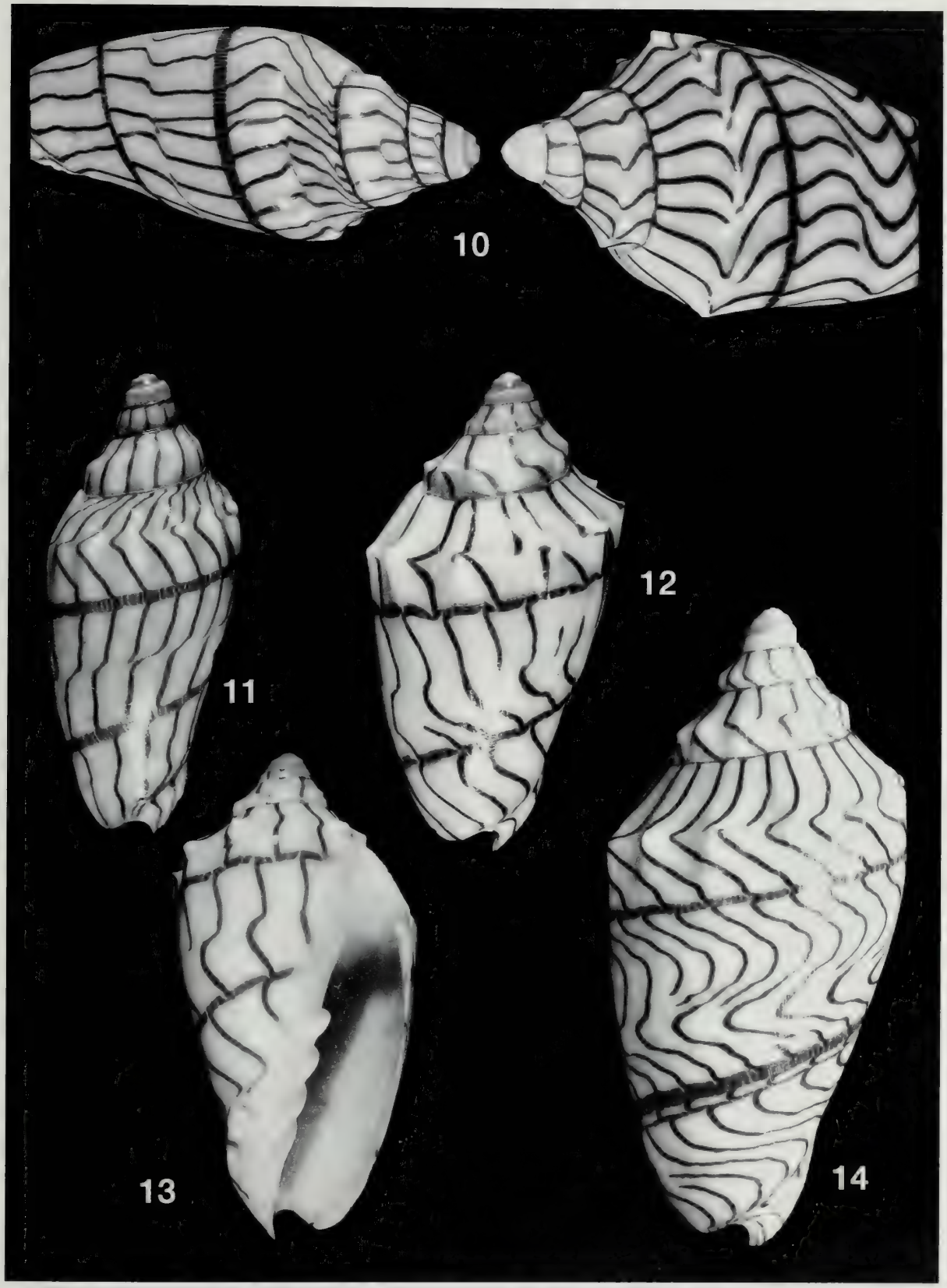


Fig. 10. Left: *Paramoria johnclarki* sp. nov. Right: *Paramoria guntheri* (E. A. Smith 1886). **Fig. 11.** *Paramoria johnclarki* sp. nov., 43.4 mm x 17.8 mm. Archipelago of The Recherche. **Fig. 12.** *Paramoria guntheri* (E. A. Smith 1886) form *adocki*, 45.6 mm x 24 mm. Same locality. Outline and comparison between two sympatric specimens. **Fig. 13.** *Paramoria guntheri* (E. A. Smith 1886) form *adocki*, 45.6 mm x 24 mm. Archipelago of The Recherche. Dixon coll. Ventral side showing the flat or slighty concave area just behind the fourth columellar plait, unlike the convexe callosity of *P. johnclarki*. **Fig. 14.** *Paramoria guntheri* (E. A. Smith 1886) form *adocki*, 59 mm x 28.4 mm. Thorney Passage, off Taylors Island. Bail coll.

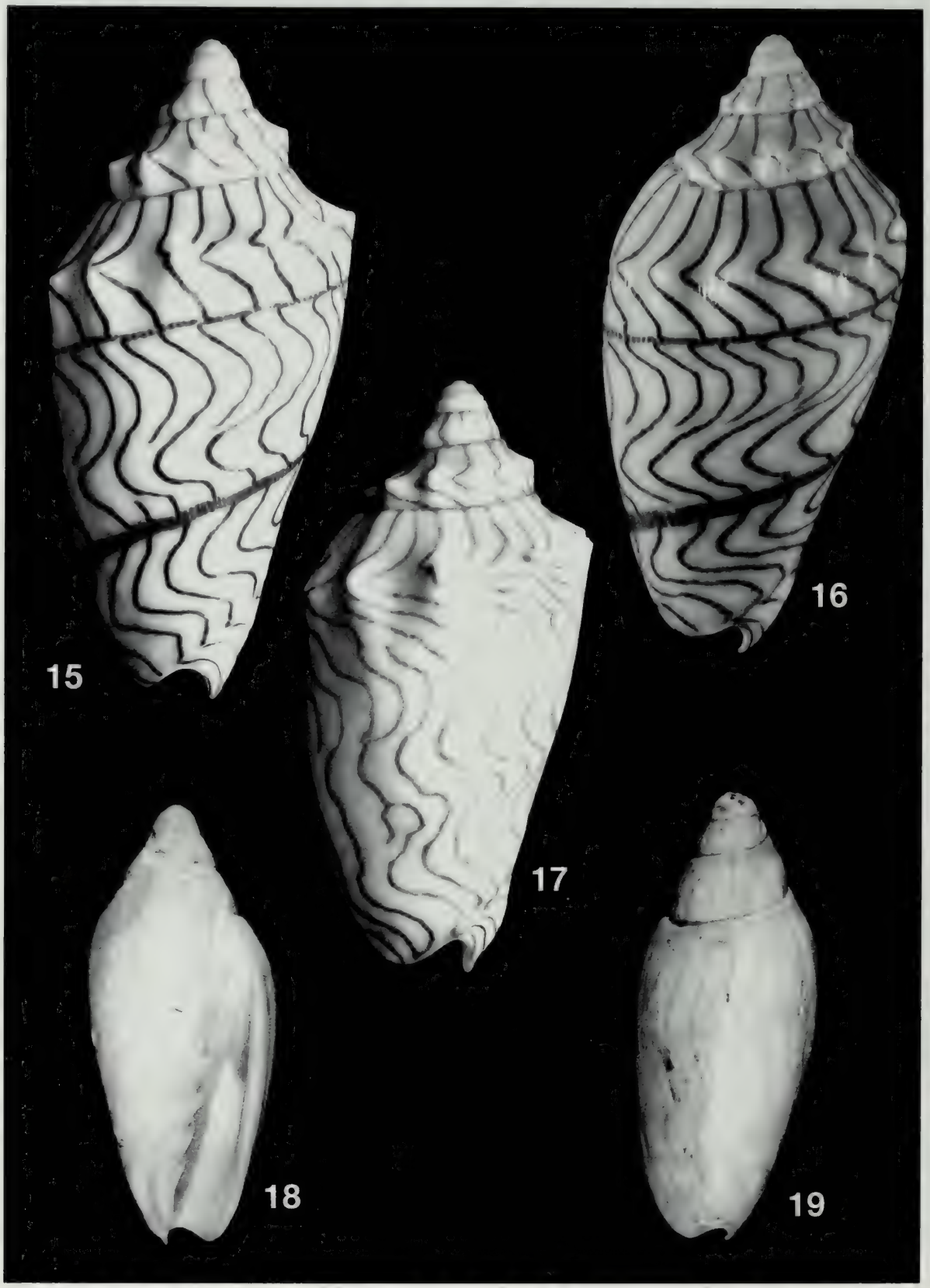


Fig. 15. *Paramoria guntheri* (E. A. Smith 1886) form *adocki*. 60.4 mm x 29.8 mm. Same locality. **Fig. 16.** *Paramoria guntheri* (E. A. Smith 1886) form *adocki*, 58.4 mm x 27.7 mm. Limpus coll. Same locality. **Fig. 17.** *Paramoria guntheri* (E. A. Smith 1886). Nominal form without spiral bands. Same locality. **Fig. 18.** *Paramoria lundeliusae* (Ludbrook 1978). 41.8 mm x 18.2 mm. Roe Plain. Bail coll. **Fig. 19.** *Paramoria lundeliusae* (Ludbrook 1978). 42.6 mm x 17.3mm. Roe Plain. Limpus coll.

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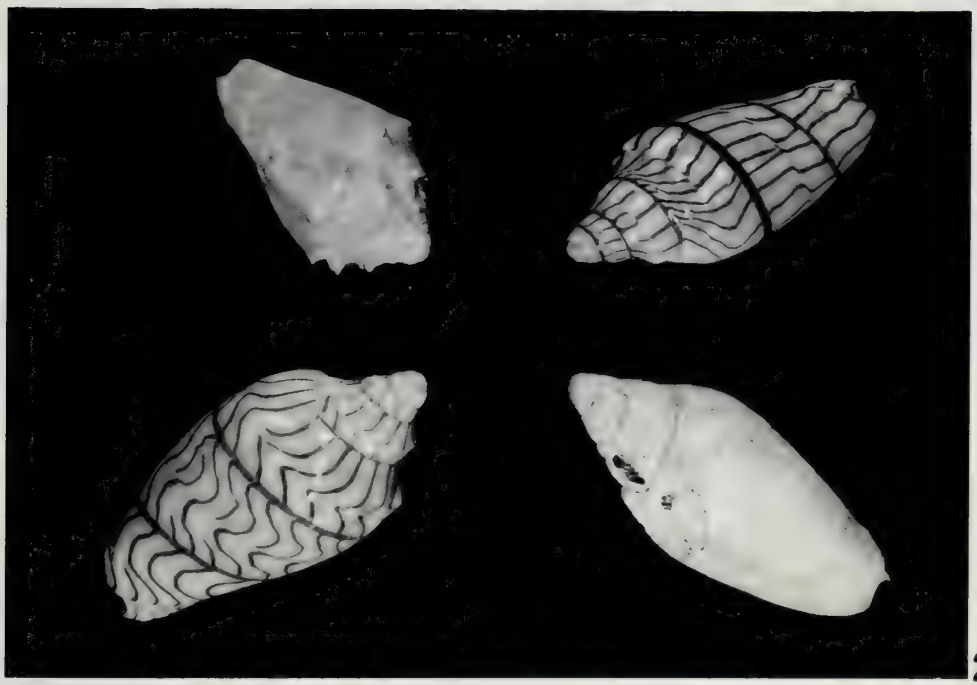

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Fig. 20. *Paramoria johnclarki* sp. nov. Living specimen crawling at daytime in 35 m. Black Island, Esperance, W. A.
Fig. 21. *Paramoria guntheri* (E. A. Smith 1886): Living specimen at night in 16 m. Taylors Island. Port-Lincoln, W. A.
Fig. 22. Upper left: *Paramoria stophodon* (McCoy 1876). Lower left: *Paramoria guntheri* (E. A. Smith 1886). Upper Right: *Paramoria johnclarki* sp. nov. Lower right: *Paramoria lundeliusae* (Ludbrook 1978).

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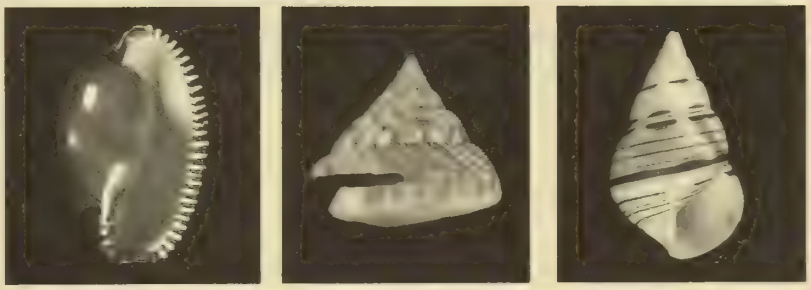

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Gauguini

Description d'une nouvelle espèce de Costellariidae des Philippines

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KEYWORDS. Gastropoda, Costellariidae, new species, Philippine Is.

RESUME. *Vexillum (Costellaria) sauternesense*, sp. nov. est décrit et comparé à *V. (C.) takakuwai* Cernohorsky & Azuma, 1974 du Japon.

ABSTRACT. *Vexillum (Costellaria) sauternesense*, sp. nov. is described from the Philippine Islands. It is compared with *V. (C.) takakuwai* Cernohorsky & Azuma, 1974 from Japan.

INTRODUCTION

Plusieurs gastéropodes mitriformes d'eau profonde ont été récemment décrits par différents auteurs. La série type de ce nouveau Costellariidae de la région Indo-Pacifique a été extraite de la collection de l'auteur. L'espèce est décrite sur base de caractères conchyliologiques.

ETUDE SYSTEMATIQUE

FAMILLE : COSTELLARIIDAE Mac Donald, 1860

GENRE : *Vexillum* Röding, 1798

SOUS-GENRE : *Costellaria* Swainson, 1840

Espèce type par monotypie : *Mitra rigida* Swainson, 1821 = *Mitra semifasciata* Lamarck, 1811

Vexillum (Costellaria) sauternesense sp. nov.

Figs 1-4

Matériel type.

Holotype : MNHN, Paris., paratype : coll. de l'auteur n° 01144.

Localité type.

Philippines. Pêché vivant, au filet, par 160 m., dans le détroit d'Hilutangan séparant l'île de Mactan et l'île d'Olango, sur fond de sable associé à des débris coralligènes.

Description.

Coquille de taille moyenne pour le genre, fusiforme allongée, tours convexes, sutures profondes subangulées à l'épaulement. Protoconque inconnue. Téléoconque composée de 9 ou 10 tours. Avant-dernier tour possédant 25 ou 26 côtes axiales et 7 ou 8 cordons spiraux. Dernier tour avec 30 ou 31 côtes axiales et 13 ou 14 cordons spiraux. L'entrecroisement des côtes axiales tuberculées avec les cordons spiraux donnent à la coquille une apparence entièrement grillagée. Ouverture ovoïde plus courte que la spire, lèvre externe fragile, crénelée, plissée en sa partie intérieure, columelle avec 5 forts plis décroissant abapicalement qui se prolongent par 6 ou 7 costules obliques peu noduleuses. bord columellaire adhérent, fasciole siphonale légèrement incurvée à sa base. Coquille de couleur blanc-crème. Ceinture brune-orangée à la périphérie des tours de la spire, au-dessus des sutures. Dernier tour orné d'une bande brune-orangée au niveau de l'angle pariétal, une seconde de même couleur juste au-dessus des fortes costules. Ouverture blanc-crème, periostracum transparent.

Dimensions.

Holotype : 42,3 x 11,5 mm ; hauteur de l'ouverture : 18,4 mm.

Paratype : 43,7 x 11,8 mm ; hauteur de l'ouverture : 20,8 mm.

Discussion.

Vexillum (Costellaria) sauternesense diffère de *V. (C.) takakuwai* Cernohorsky & Azuma, 1974 du Japon (CERNOHORSKY, 1978) (Fig. 5) par ses tours plus convexes, sa suture plus profonde, son ouverture ovoïde, son bord columellaire adhérent et son dernier

tour orné de 30 ou 31 côtes axiales et de 13 ou 14 cordons spiraux au lieu de 22 ou 23 côtes axiales et 15 ou 16 cordons spiraux chez *V. (C.) takakuwai*. Elle diffère également par sa couleur et ses bandes subsuturales blanc-crème, alors que *V. (C.) takakuwai* présente une coquille blanc sale avec des ponctuations brunes dans les sillons intercostaux. Une espèce proche de *V. (C.) sauternesense* est erronément représentée sous l'identité de *V. (C.) obeliscus* (Reeve, 1844) par SPRINGSTEEN & LEOBRERA (1986 : 212, pl. 58, Fig. 21). *V. (C.) obeliscus* est une espèce distincte, illustrée par CERNOHORSKY (1967) et par TURNER (1989) et qui ne nécessite pas de comparaison ici.

Etymologie.

En l'honneur d'un vin liquoreux remarquable d'une région vinicole française.

REMERCIEMENTS. Je suis tout particulièrement reconnaissant à H. Turner, Rovio, Suisse, à R. Salisbury, Idaho, U.S.A., et à W.O. Cernohorsky, Auckland, Nouvelle-Zélande, pour leurs remarques et conseils avisés, à R. Houart, IRSNB, Bruxelles, Belgique, pour la lecture et la correction du manuscrit, à P. Bail, Paris, pour les clichés des types, et à ma femme, pour sa coopération.

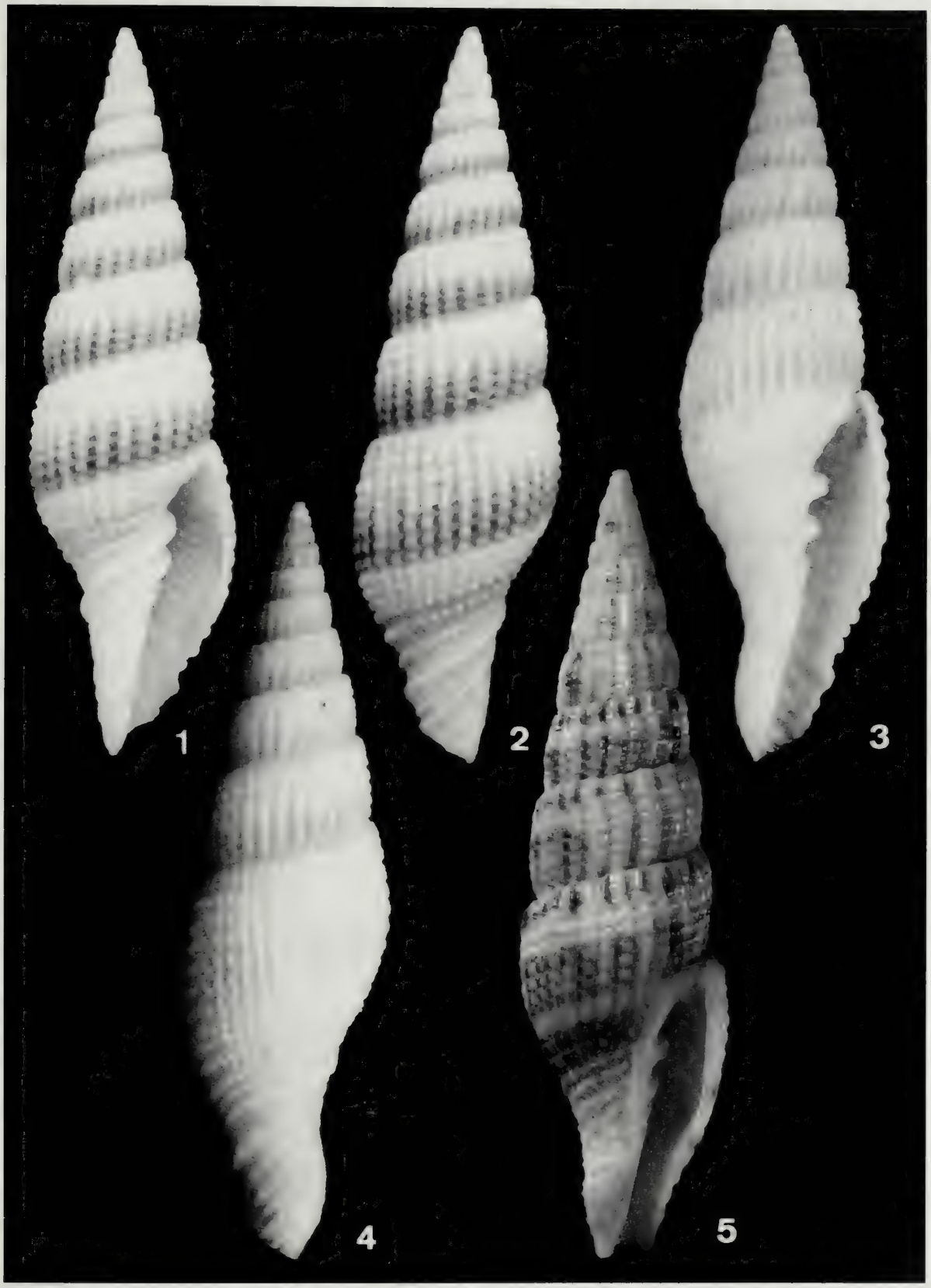
RÉFÉRENCES

CERNOHORSKY, W.O. 1967. *Marine Shells of the Pacific (1)*. Pacific Publications, Sydney. 248pp.

CERNOHORSKY, W.O. 1978. The taxonomy of some Indo-Pacific Mollusca (6). *Bull. Inst. Mus.* 15 : 67-86.

SPRINGSTEEN, F.J. & F.M. LEOBRERA. 1986. *Shells of the Philippines*. Manila, Carfel Seashell Museum. 377 pp.

TURNER, H. 1989. Mitroidea peu communes ou nouvelles de l'Indo-Pacifique, partie 1. *Bull. Soc. Inter. Conch.* 11 (4) : 14-30.



Figs. 1-4. *Vexillum (Costellaria) sauternesi* n.sp., Détroit d'Hilutangan, Philippines, 160 m. **1-2.** Holotype MNHN, 42,3 mm. **3-4.** Paratype coll. G. de Suduiraut n° 01144, 43,7 mm.
Fig. 5. *V. (C.) takakuwai* Cernohorsky & Azuma, 1974. Holotype Auckland Institute and Museum, 38,4 mm. (photo H. Turner).

Description of *Pterynotus laurae* n.sp. from the Philippine Islands (Gastropoda, Muricidae, Muricinae)

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KEYWORDS. Gastropoda, Muricidae, Muricinae, Philippine Is., *Pterynotus*, n.sp.

ABSTRACT. *Pterynotus laurae* n.sp. is described. The species is currently restricted to the Sulu Sea in the Philippine Islands. It is compared with *P. albobrunneus* Bertsch & D'Attilio, 1980 from the Indian Ocean. Two other species, *P. pinnatus* (Swainson, 1822) and *P. pellucidus* (Reeve, 1845) are illustrated for further comparison.

RESUME. Une nouvelle espèce, *Pterynotus laurae* n.sp. est décrite de la Mer de Sulu, dans les Iles Philippines. Elle est comparée à *P. albobrunneus* Bertsch & D'Attilio, 1980 de l'Océan Indien et à *P. pinnatus* (Swainson, 1822) et *P. pellucidus* (Reeve, 1845) de l'Indo-Pacifique. Toutes les espèces sont illustrées.

Abbreviations

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

NM: Natal Museum, Pietermaritzburg, South Africa.

WPU: Wilhelm-Pieck-Universität, Rostock, Germany.

SYSTEMATIC ACCOUNT

FAMILY : MURICIDAE Rafinesque, 1815

SUBFAMILY : MURICINAE Rafinesque, 1815

GENUS : *Pterynotus* Swainson, 1833

Type species by original designation: *Pterynotus pinnatus* (Swainson, 1822); Recent, Indo-West Pacific.

Pterynotus laurae n.sp.

Figs 1-4

Material examined.

Philippine Islands, Sulu Sea: holotype MNHN; 1 paratype coll. R. Houart.

Description.

Shell medium sized for the genus, up to 46.4 mm in length (holotype) (Figs 2-3), heavy, squamous. Spire high with 1.5 protoconch whorls, and up to 7 broad, weakly shouldered teleoconch whorls. Suture adpressed. Protoconch large, broad, irregularly shaped, smooth (Fig. 1). Terminal varix unknown (eroded). Axial sculpture of teleoconch whorls consisting of high, broad, webbed varices. Other axial sculpture of numerous growth lamellae. First and second whorls with 7 lamellate nodes, third to last with 3 varices and one high intervarical node near preceding varix. Spiral sculpture of high, strong, squamous, primary and secondary cords, and additional narrow threads. First and second whorl with 3 cords and 1 on shoulder, third with 4 cords and 1 on shoulder, fourth with 4 and 2-4 on shoulder, fifth and sixth with 4 and 3 or 4 on shoulder, last whorl with 9 or 10 cords and 4 or 5 on shoulder. Narrow, squamous threads occasionally between cords.

Aperture ovate. Columellar lip flaring, smooth; rim partially erect, adherent at adapical extremity, briefly expanded adapically. Anal notch broad, delineated by small node. Outer lip erect, denticulate, with 7 or 8 strong, elongate denticles within.

Siphonal canal moderately long, broad, weakly abaxially recurved, open, adaperturally bent at extremity; ornamented with 4 primary spiral cords and 2-5 narrow threads between cords.

Light and dark brown; protoconch, first and second teleoconch whorls milky white, third whorl light brown, fourth to last whorl darker coloured, decreasing in darkness from fourth to last whorl. Spiral cords weakly lighter coloured. Aperture white. Operculum and radula unknown.

Discussion.

Pterynotus laurae n.sp. resembles *P. albobrunneus* Bertsch & D'Attilio, 1980, known from South Africa to Oman and south-west India (Fig. 9) (VOKES, 1978; BERTSCH & D'ATTILIO, 1980; MILLARD, 1990; BOSCH et al, 1995; coll. MNHN, NM, WPU, R. Houart). However, the shell of *P. laurae* is broader, especially the last teleoconch whorl. The spiral cords are broader and less numerous than in *P. albobrunneus*. *P. laurae* bears 4 or 5 cords on the shoulder of the last whorl, 9 or 10 on body, and 4 primary cords on the siphonal canal, while *P. albobrunneus* has 12-15 cords and threads on shoulder, 10 or 11 on body, and 5 or 6 cords on the siphonal canal. It is also interesting to note the decreasing of darkness in colour from fourth to last whorl in *P. laurae* and the lighter coloured spiral cords, while the last whorl is darker coloured in *P. albobrunneus*, with a dark brow line on the top of the spiral cords on almost the whole shell.

I have not been able to study *P. albobrunneus* with preserved protoconch, but it is quite interesting to note the irregularly shaped protoconch of *P. laurae*, and its variability in thickness; the protoconch of the holotype is almost twice the size of these of the paratype. The irregular shape and the difference of thickness of the protoconch could be the results of an intracapsular development, leading probably to a restricted geographical distribution of the species.

Pterynotus pinnatus (Swainson, 1822) (Fig. 7) and *P. pellucidus* (Reeve, 1845) (Fig. 8) are two other members of this group of similar looking shells. However, they differ in having a conical, multispiral protoconch. They are here illustrated for information and further comparison.

Etymology.

At the request of J.-P. Barbier, I am pleased to name this new species for his daughter, Laure.

ACKNOWLEDGEMENTS. I am very indebted to Mr. Jean-Pierre Barbier (Paris) who gave me the opportunity to study these specimens and for the gift of the material. Thanks also to Dr. R.N. Kilburn (Natal Museum, Pietermaritzburg) and to Dr. P. Bouchet and Mrs V. Héros (Muséum National d'Histoire Naturelle, Paris) for the loan of additional specimens of *Pterynotus albobrunneus*.

REFERENCES

BERTSCH, H., & A. D'ATTILIO. 1980. New species of Muricidae (Gastropoda) from the Indian Ocean, the Philippines and Brasil. *Venus* 39 (3): 131-138.

BOSCH, D.T, S.P. DANCE, R.G. MOOLENBEEK, P.G. OLIVER. 1995. *Seashells of Eastern Arabia*. S.P. Dance, Motivate Publishing: 296 pp.

MILLARD, V. 1990. Some Muricidae from South Africa. *The Strandloper* 227: 2-11.

VOKES, E.H. 1978. Muricidae (Mollusca: Gastropoda) from the eastern coast of Africa. *Ann. Natal Mus.* 23 (2): 375-418.

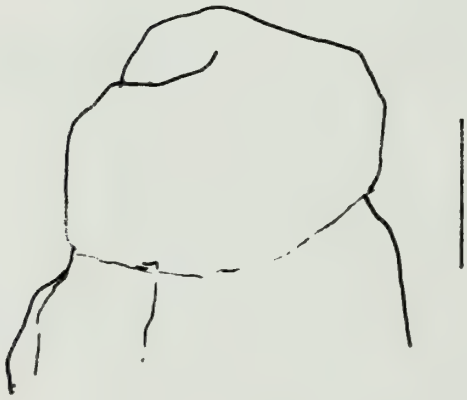

Fig. 1. Protoconch of *Pterynotus laurae* n.sp. (holotype MNHN); scale bar: 0.5 mm.

Figs. 2-4. *Pterynotus laurae* n.sp., Philippine Islands, Sulu Sea. **2-3.** Holotype MNHN, 46.4 mm. **4.** Paratype coll. R. Houart, 45.5 mm.
Figs. 5-6. *Pterynotus albobrunneus* Bertsch & D'Attilio, 1980. **5.** India, Trivandurum, coll. R. Houart, 44.6 mm. **6.** Seychelles, MNHN, 23.1 mm.

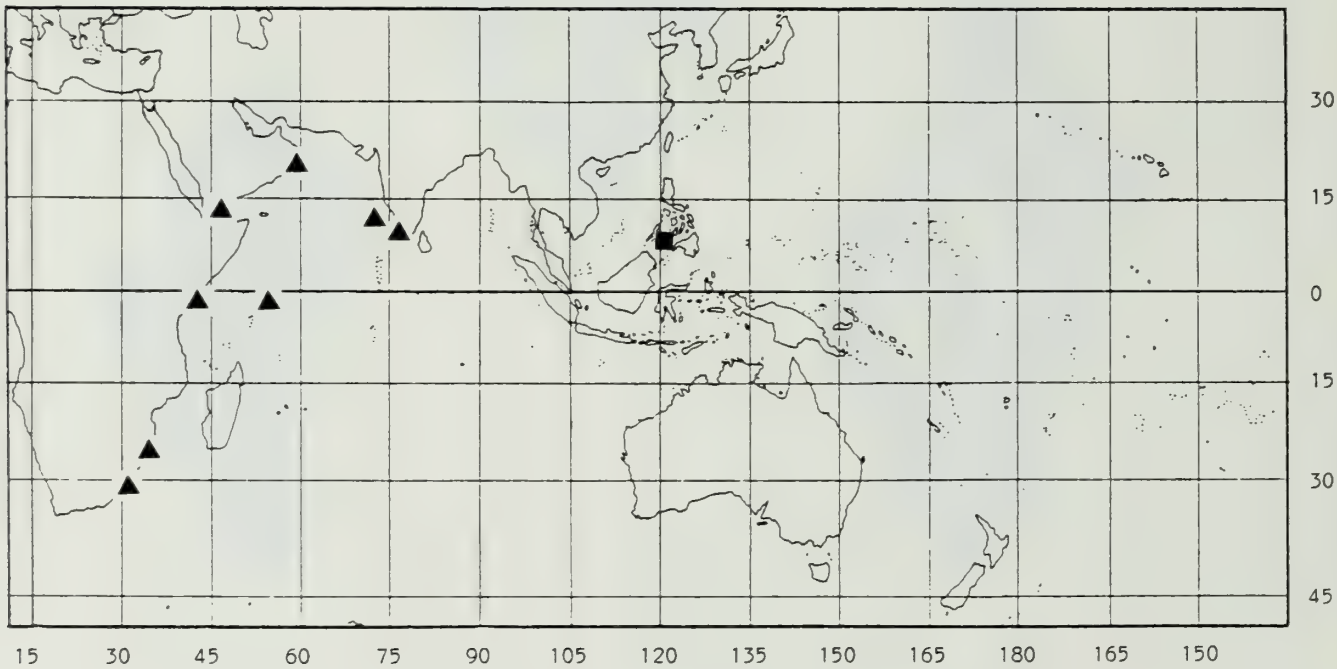

Fig. 7. *Pterynotus pinnatus* (Swainson, 1822), Japan, coll. R. Houart, 57.2 mm.
Fig. 8. *Pterynotus pellucidus* (Reeve, 1845), Japan, coll. R. Houart, 54.3 mm.
Fig. 9. Geographical distribution of *Pterynotus albobrunneus* and of *Pterynotus laurae* n.sp.
▲ *P. albobrunneus* Bertsch & D'Attilio, 1980. ■ *P. laurae* n.sp.

Description of a new species of *Drupa* Röding, 1798 (Gastropoda: Muricidae: Rapaninae) from the Western Indian Ocean

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KEYWORDS. Gastropoda, Muricidae, Rapaninae, *Drupa*, n.sp.

ABSTRACT. *Drupa denticulata* n.sp. is described. The species is restricted to Northeast Madagascar and to Réunion, and is compared with *Drupa morum morum* (Röding, 1798) from the Indo-West Pacific and *Drupa morum iodostoma* (Lesson, 1840), a subspecies endemic to the Marquesas Islands (French Polynesia).

RESUME. Une nouvelle espèce, *Drupa denticulata* n.sp. est décrite de la Réunion et de Madagascar. Elle est comparée à *Drupa morum morum* Röding, 1798 de l'Indo-Pacifique et à *Drupa morum iodostoma* une sous-espèce endémique aux Iles Marquises (Polynésie Française).

INTRODUCTION

This paper is the result of many comparisons of *Drupa* species during the last 20 years or so. Apart from the study material listed many unlisted lots were examined in private and museum collections. *Drupa denticulata* n.sp. resembles *D. morum morum* (Röding, 1798), a more globose and more nodose species, with which it is probably sympatric at Madagascar and Réunion, and its subspecies *D. morum iodostoma* (Lesson, 1840). The genus *Drupa* was revised by EMERSON & CERNOHORSKY (1973).

The distinction between the two species uses basically the methods of the statistical inference to establish the discrimination level of the studied measures.

MATERIAL AND METHODS

Measurements

The following measurements have been used:

a: Length of the shell, parallel to the axis, from the apex to the extremity of the siphonal canal.

b: Largest breadth, including knobs.

c: Height of two adapical groups of outer apertural denticles.

d: Height of columellar folds.

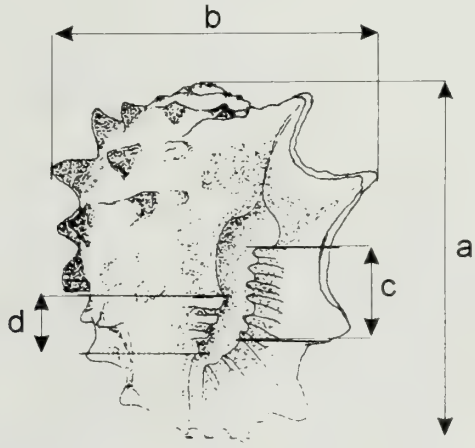


Fig. 1. Shell measurements for *Drupa*.

To describe the distribution of the three ratios b/a, c/a and d/a for the two samples, two and three dimensional graphics (scatter diagrams) have been used.

The statistical study was made by using the hypothesis tests that investigate if the difference between the observed means for b/a, c/a and d/a are significative at a significance level of 5 or 1 percent.

The first test of means comparison was based on the sampling distribution of the means difference. The way to do this was the classical one.

The second test is based on a variance analysis, using the Fisher's distribution. A discriminant analysis was also carried out. These analysis, and the graphics corresponding, were built with the software SAS release 6.12 (ANOVA and CANDISC procedures).

Abbreviations

AMS: The Australian Museum, Sydney, Australia.

EPHE: Ecole Pratique des Hautes Etudes, Perpignan, France.

IRSNB: Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium.

JT: collection of Jean Tröndlé.

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

NM: Natal Museum, Pietermaritzburg, South Africa.

NMNZ: Museum of New Zealand, Wellington.

RH: collection of Roland Houart.

SYSTEMATIC ACCOUNT

GENUS : *Drupa* Röding, 1798

Type species by subsequent designation (Rovereto, 1899): *Drupa morum* Röding, 1798; Recent, Indo-West Pacific.

Drupa morum morum Röding, 1798
Fig. 6, table 1

Drupa morum Röding, 1798: 55, refers to Martini figs 972, 973.

Canrena neritoidea Link, 1807: 126, refers to Martini, restricted to figs 972, 973 by Cernorhorsky (1969).

Ricinula horrida Lamarck, 1816: 1, pl.395, figs 1a,b.

Ricinella violacea Schumacher, 1817: 240, refers to Martini figs 972, 973.

Ricinula globosa Mörch, 1852: 88, refers to Martini, figs 972, 973.

Material examined.

MADAGASCAR: MNHN (1); Taolagnaro (Fort Dauphin) RH (15); Toliara (Tulear), RH (2); ca. 25 kms N of Toliara (Tulear), RH (2); Nosy Be, RH (2); REUNION: RH (1); coll. M. Jay (28); Saint Pierre, S coast, RH (2); Boucan Canot, W coast, RH (2); Baie de la Possession, NW coast, RH (2); Sainte Rose, E coast, RH (2); MAURITIUS: MNHN (1); SEYCHELLES: IRSNB IG 10591 (6); MNHN (5) (7); RED SEA: MNHN (3) (7), RH (1); Port Sudan, RH (1); THAILAND: Phuket, RH (1); Ko Phi Phi, RH (1); INDONESIA: Bay of Jakarta, IRSNB IG 10591 (2) ; South Java, IRSNB IG 10591 (6); Sanghiang Island, between Java and Sumatra, RH (2); Bali, RH (3); Bali, Samur, RH (1); Kai-Tioor, RH (2); Ambon, Leitumur, Batumerah, RMNH (1); Ambon, ca. 3-4 km NW of Hutumuri, RMNH (2); Ambon, Leitimur, Cape Nasaniwe, RMNH (10); Ambon, SE side of Pombo Island, RMNH (11) RH (2); Ambon, Leitimur, Latuhalat, RMNH (2); Ambon,, Leitimur, Hutumuri, RMNH (5); Ambon, Hitu, S side Larike, RMNH (6); Papua, New Guinea, IRSNB IG 10591 (4); PAPUA NEW GUINEA: Hansa Bay, Laing Island, RH (1); PHILIPPINES: IRSNB IG 10591 (21), MNHN (1); TAIWAN: RH (2); JAPAN: Okinawa, RH (2); Japan, RH (3); Japan, Enoshima Beach, RH (1); SOLOMON IDS: IRSNB IG 10591 (7); AUSTRALIA: Queensland, Hastings Reef, RH (2); Queensland, Cairns, RH (2); North Queensland, Briggs Reef, RH (1); NEW CALEDONIA: MNHN (9) (4) (5) (2) (2); New Caledonia, IRSNB IG 10591 (3) (16); Lifou, IRSNB IG 10591 (1); Iles des Pins, IRSNB IG 10591 (4); FRENCH POLYNESIA: Society Archipelago, Mopelia IRSNB IG 10591 (17); Tahiti, IRSNB IG 10591 (3); Tuamotu Archipelago, Hikueru, IRSNB IG 10591 (3); Taenga, IRSNB IG 10591 (3); Rangiroa, RH (2); HAWAII: MNHN (7); RH (1); Hawaii, Hilo, IRSNB IG 10591 (2); Hawaii, Kalua-Kona, RH (3). FRENCH POLYNESIA [additional material listed by TRÖNDLÉ & HOUART (1992)]: Society Archipelago, Tahiti (EPHE, MNHN, JT), Moorea (EPHE, MNHN), Scilly (EPHE), Raiatea, Mopelia (MNHN); Tuamotu Archipelago: Takapoto (EPHE), Makemo, Fakahina, Napuka, Marokau, Tuanake, Motutunga, Hikureu, Fakarava, Hao, Amanu, Marutea (MNHN), Nukutavake (MNHN), Mururoa, Anaa (JT); Gambier: Taraouroa (MNHN), Mangareva (JT); Australes: Raevavae, Tubuai, Rurutu (EPHE); Rapa (EPHE).

Drupa morum iodostoma (Lesson, 1840)
Fig. 7

Purpura (Ricinula) iodostoma Lesson, 1840: 355

Material examined.

FRENCH POLYNESIA: Marquesas Ids: Ua Huka, Fatu Hiva, Tahuata (EPHE), Nuku Hiva (EPHE, JT, RH), Ua Pou (EPHE, RH), without any other locality data (MNHN). Listed by TRÖNDLÉ & HOUART (1992).

Drupa denticulata n.sp.

Figs 2-5, table 2

Type material.

Holotype IRSNB IG 28515/477, St. Pierre, Réunion; paratypes: 1 AMS C.203253; 1 MNHN; 1 NM L3580/T1462; 1 NMNZ M. 272616, Réunion; 1 RH, St. Denis, Réunion.

Other material examined.

Fort Dauphin (Taolagnaro, Northeast Madagascar), IRSNB IG 10591 (1); Réunion: RH (8), coll. M. Jay (5); St. Gilles-les-Bains, MNHN (1).

Description.

Shell medium sized for the genus, up to 39.3 mm high at maturity, rounded, heavy, weakly nodose, spire low. Protoconch unknown (eroded in all examined specimens). Teleoconch with up to 4 broad, rounded whorls, suture adpressed. Spiral sculpture of last whorl consisting of 3 adapical, high spiral rows of knobs and 2 low, smooth, abapical cords. First adapical row bordering suture, second delimiting shoulder, third on periphery. Additional spiral sculpture of low, broad, irregular cords.

Aperture narrow, elongate, about 60-70 % of total shell height. Columellar lip broad, callused, ornamented with 4 strong abapical folds and 1 or 2 lower folds just above siphonal canal. Anal notch deep, elongate. Outer lip with 2 groups of strong denticles: adapical group consisting of 4 denticles; abapical group of 2, 3 or occasionally 4 denticles; 2 weaker additional denticles near siphonal canal. Siphonal canal short, open. White or greyish, knobs usually dark brown or black. Aperture purple with lighter coloured or white teeth and folds.

Discussion.

Drupa denticulata n.sp. resembles *D. morum morum* but has a smoother shell with three adapical spiral rows of knobs on the last teleoconch whorl, and two low, nearly obsolete abapical rows. In *D. morum morum* there are usually four high spiral rows of knobs, and one low abapical spiral row of knobs on last whorl. The shell of *D. denticulata* is narrower than *D. morum morum* relative to its total height, and the heights of the columellar folds and apertural denticles are greater relative to the total shell height (Fig. 1; Tables 1-2,). The apertural denticles are usually lower, and the columellar folds are broader in *D. denticulata* than in *D. morum morum*. The edge of the columellar lip is properly delimited in fully adult specimens of *D. denticulata*, and usually ornamented with a narrow, brown border. In all specimens of *D. morum morum* seen the margin of the columellar lip is irregular and not clearly delimited. *D. denticulata* is also smaller and the height is more regular (32-39 mm) than *D. morum morum*, which are commonly 28-46 mm in height.

Drupa morum iodostoma, a subspecies endemic to the Marquesas, has a broader shell with five low, smooth spiral cords on the last whorl. Its apertural features are identical to the nominal subspecies, but the colour is pinkish or violet instead of purple as in *D. morum morum*, and in *D. denticulata* n.sp.

Etymology.

denticulata (L): refering to its strong apertural teeth.

Locality	(a) mm	(b) mm	(c) mm	(d) mm
Réunion (Jay)	46.7	43.5	12.0	10.2
Réunion (Jay)	44.1	42.7	11.4	9.2
Ko Phi Phi, Thailand (RH)	42.5	41.2	12.4	9.9
Nosy Be, Madagascar (RH)	38.2	35.7	10.2	8.8
Nosy Be, Madagascar (RH)	37.9	36.4	10.2	9.3
Réunion (Jay)	36.8	35.9	10.8	8.7
Enoshima Beach, Japan (RH)	35.1	34.9	10.0	7.9
Tulear, Madagascar (RH)	34.6	33.1	8.8	6.9
St. Pierre, Réunion (RH)	34.2	34.0	9.7	7.7
Bali (RH)	33.0	30.0	8.7	6.0
Baie de la Possession, Réunion (RH)	32.7	30.3	9.0	7.1
Ste Rose, Réunion (RH)	32.1	30.0	9.1	7.7
Réunion (Jay)	31.6	30.3	8.0	6.2
Ambon, Indonesia (RH)	31.0	28.4	8.2	7.9
Baie de la Possession, Réunion (RH)	27.8	25.3	7.1	6.0

Table 1. Shell measurements for *Drupa morum morum* Röding, 1798

Locality	(a) mm	(b) mm	(c) mm	(d) mm
Réunion (RH)	39.3	28.8	11.0	9.8
Réunion (RH)	39.1	32.0	11.3	9.8
Réunion (RH)	38.6	34.3	11.6	11.4
Taolagnaro, NE Madagascar (IRSNB)	37.9	31.8	10.7	9.0
Réunion (Jay)	37.6	30.4	12.2	10.6
Réunion (Jay)	37.4	29.9	10.8	9.5
Réunion (Jay)	36.7	27.6	10.7	9.2
Réunion (Jay)	36.6	29.8	12.3	11.7
Réunion (paratype NMNZ)	36.6	28.4	10.7	9.0
Réunion (RH)	35.7	28.7	11.1	10.4
Réunion (paratype NM)	35.0	30.0	10.2	9.7
Réunion (RH)	34.5	25.6	10.9	9.8
Réunion (holotype MNHN)	34.4	27.4	10.4	9.7
Réunion, St. Denis (paratype RH)	33.9	27.4	11.6	9.4
Réunion (paratype AMS)	32.8	30.3	10.0	9.6

Table 2. Shell measurements for *Drupa denticulata* n.sp.

RESULTS

Descriptive statistic

The diagrams of the values distribution shows obviously the existence of two distinct groups.

The two dimensional X-Y representation of the ratio studied in pairs are given in Figs 2 and 3.

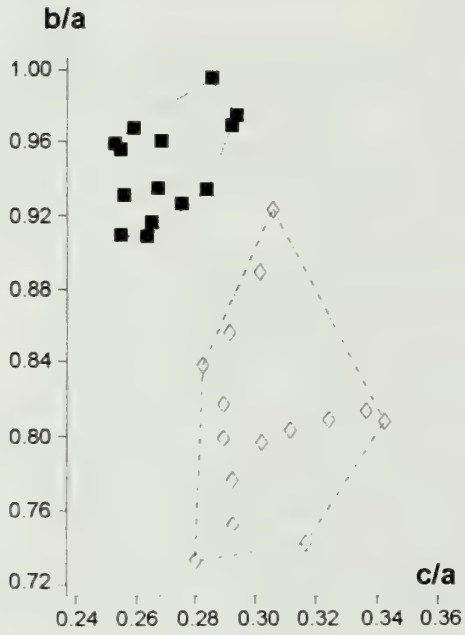


Fig. 2. *Drupa morum morum* (black squares) and *Drupa denticulata* (lozenges). Scatter diagram of c/a *vs* b/a.

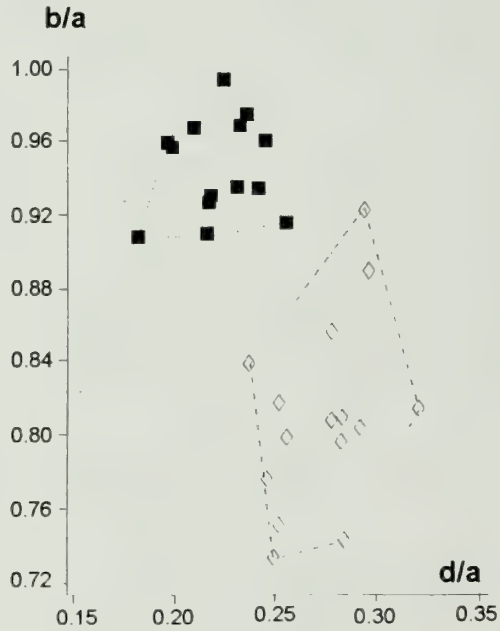


Fig. 3. *Drupa morum morum* (black squares) and *Drupa denticulata* (lozenges). Scatter diagram of d/a *vs* b/a.

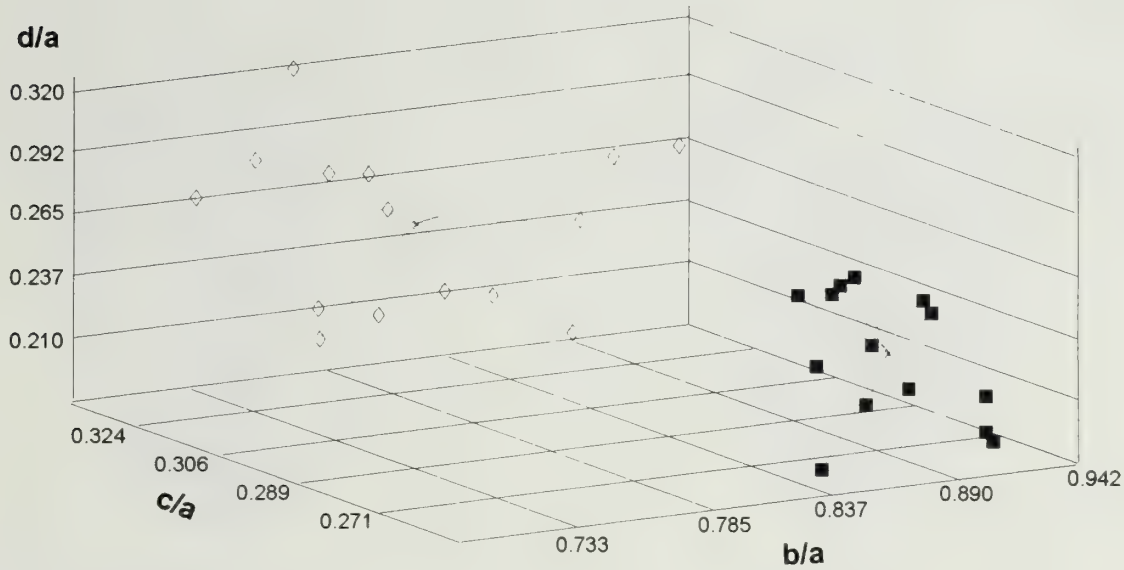


Fig. 4. *Drupa morum morum* (black squares) and *Drupa denticulata* (lozenges). Diagram of d/a *vs* c/a *vs* b/a. The different points have been connected to the respective mean of the three ratios for the suspected groups.

The three dimensional diagram illustrated in Fig. 4, built upon the three ratios, clearly evidence the separation of the two groups.

Statistical inference

The comparison test of the means of three ratios for the two groups was built on the study of the sampling distribution of the means difference. The results of the hypothesis tests was that, in the two cases, one can consider that the difference between the means are significant at a level at least equal to 5 percent.

The analysis of variance for the three ratios, treated by the SAS procedure ANOVA, give the following result : the equality of the means hypothesis can therefore be rejected, disregard the significance level (5 or even 0.1 percent), because the probability for a wrong rejecting of the null hypothesis (the "p-value"), corresponding to the degrees of freedom (DF), has a value of 0.0001.

The multivariate analysis, taking account of the three ratios, shows similar results.

Last but not least, the canonical discriminant analysis (SAS CANDISC procedure) fully confirms the total separation of the two groups (Exact Statistic F= 54.46, p= 0.0001).

CONCLUSION

From an inferential statistical point of view, the tests allow to consider that the difference of the studied quantities, observed for the sample and estimated for the population, is significant.

ACKNOWLEDGEMENTS. For additional material, information or other help we are most indebted to P. Bouchet and V. Héros, Muséum National d'Histoire Naturelle, Paris; J. Drivas, Skripero, Greece; M. Jay, St. Gilles-les-Bains, Réunion; J.C. Martin, St. Denis, Réunion; J. Van Goethem, A. Lievrouw and staff of the department of Recent Invertebrates of the Institut Royal des Sciences Naturelles de Belgique. My sincerest thanks also to B.A. Marshall, National Museum of New Zealand, Wellington, for critically reading the manuscript.

REFERENCES

DAGNELIE, P. 1970. Théorie et méthodes statistiques – Applications agronomiques (Vol. 1 & 2). Ed. Duculot S.A., Gembloux (Belgium).

EMERSON, W.K. & W.O. CERNOHORSKY, 1973. The genus *Drupa* in the Indo-Pacific. *Indo-Pacific Mollusca* 3(13): 1-40.

LAMARCK, J.B.P.A., de M. de. 1816. Tableau encyclopédique et méthodique des trois règnes de la nature, 23è part., mollusques et polypes divers, Paris: pls. 391-488.

LESSON, R.P. 1840. Molluscorum species novae. *Rev. Zool. Soc. Cuverienne*: 355-356.

LINK, H.F. 1807. Beschreibung der Naturalien-Sammlung der Universität zu Rostock, Rostock: 1-160.

MÖRCH. 1852. Catalogus Conchyliorum quae reliquit d. Alphonso d'Aguirra & Gadea Comes de Yoldi, regis daniae cubiculariorum princeps, ordinis dannebrogici

in prima classe & ordinis caroli Tertii eques. Klein, Hafniae. Part 1. *Cephalophora*. :1-170.

RÖDING, J.F. 1798. Museum Boltenianum... Hamburg: i-vii, 1-199.

SAS. 1990. SAS/STAT User's guide Vol. 1 & 2 - Version 6 (4th edition).

SCHUMACHER, H.C.F. 1817. Essais d'un nouveau système des vers testacés. Schultze, Copenhagen: 1-287.

TRÖNDLÉ, J. & R. HOUART. 1992. Les Muricidae de Polynésie Française. *Apex* 7 (3-4): 67-149.

VILVENS, C., 1997. Inférence statistique. Notes de cours. ASBL DEFI, HEP Rennequin Sualem (Computer Science department - INPRES), Seraing.

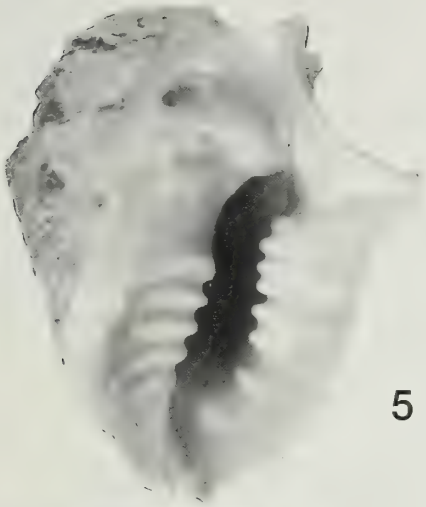
VILVENS, C. 1997. Introduction au système SAS. Notes de cours. ASBL DEFI, HEP Rennequin Sualem (Computer Science department - INPRES), Seraing.

Figs 5-10 (opposite page).

Figs 5-7. *Drupa denticulata* n.sp. **5.** Holotype IRSNB IG 28515/477, St. Pierre, Réunion, 32 mm. **6.** Paratype MNHN, Réunion, 34.3 mm. **7.** Paratype RH, St. Denis, Réunion, 33.8 mm.

Fig. 8-9. *D. morum morum* Röding, 1798. **8.** Thailand, 42 mm, coll. R. Houart. **9.** Baie de la Possession, Réunion, 33 mm, coll. R. Houart.

Fig. 10. *D. morum iodostoma* (Lesson, 1840), Marquesas, 35 mm, coll. R. Houart.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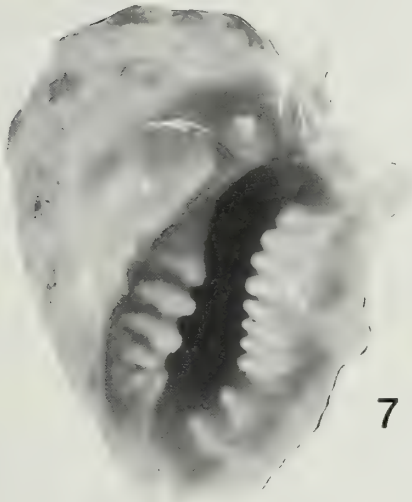
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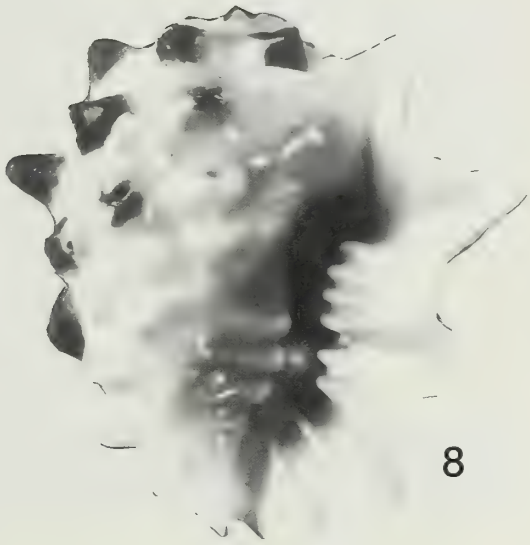
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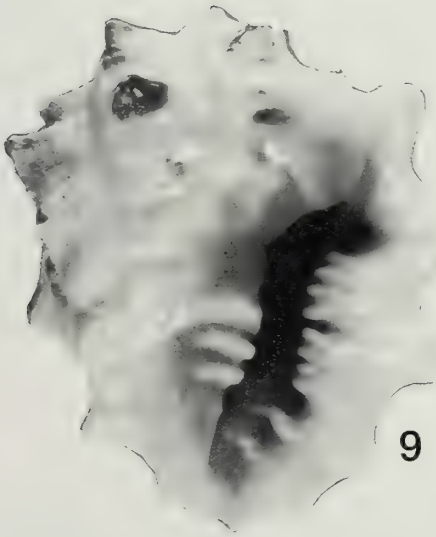
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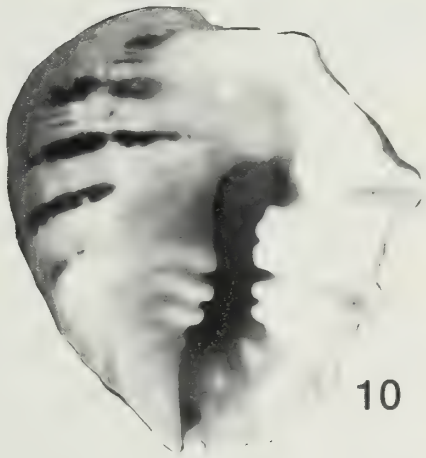
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E. Guillot **de Suduiraut**	Description d'une nouvelle espèce de Costellariidae des Philippines	erratum.

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